UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

January18, 2000

MEMORANDUM

SUBJECT: **Atrazine.** Anticipated Residues and Acute and Chronic Dietary Exposure Assessments for Atrazine, Revised January 2001
Chemical No. 80803; DP Barcode D272010

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Background/Action Requested

Perform acute and chronic DEEM^{TM} dietary exposure assessments for atrazine and the chloro-metabolites of atrazine. Compare the exposure from these combined residues to the toxicological endpoint for atrazine. Also perform a chronic dietary exposure assessment for the hydroxy-metabolites of atrazine. Compare the exposure from the combined hydroxy-metabolite residues to the toxicological endpoint for hydroxyatrazine. (For convenience in this document, 2-hydroxy-4-ethylamino-6-isopropylamino-s-triazine is called hydroxyatrazine.) A toxicological endpoint has not been identified for acute exposure to the hydroxy-metabolites of atrazine.

Executive Summary

Acute and chronic dietary exposure assessments have been performed for atrazine and its chloro-metabolites. These are moderately refined Tier 3 assessments. They depend primarily upon field trials and metabolism studies. They incorporate monitoring data only for wheat grain, and incorporate processing information only for sugarcane commodities. For both exposure assessments, all relevant population subgroups had exposures below their respective population adjusted doses (PADs) based on the atrazine toxicological safety endpoints. (100% of the PAD is HED's level of concern.) For the acute (1-day) effects, the Hazard Identification and Review Committee (HIARC) has determined that there is no appropriate endpoint for acute effects for the general population, including infants and children; the only relevant population subgroup in the acute exposure assessment was "females, 13-50 years old" (R. Hawks, HIARC memo, 8/28/00). This population subgroup's exposure was estimated to be at <1% of the acute population adjusted dose (aPAD) at the 99.9th percentile exposure. The most highly exposed population subgroup in the chronic exposure assessment for atrazine and its chloro-metabolites was "children 1-6 years old," at <1% of the cPAD.

In addition, a chronic dietary exposure assessment was performed for the hydroxy-metabolites of atrazine. For this exposure assessment, all population subgroups had exposures below the chronic PAD. The most highly exposed population subgroup in the chronic exposure assessment was "children 1-6 years old," at <1% of the cPAD for the hydroxy-metabolites of atrazine. An acute toxicological endpoint for hydroxyatrazine was not identified, so an acute dietary exposure assessment was not required.

<u>Detailed Considerations</u>

Exposure Assessment Information

These exposure assessments were performed using Dietary Exposure Evaluation Model (DEEM™) version 7.075. DEEM™ software was developed by Novigen Sciences, Inc to perform dietary exposure analyses. DEEM™ software enables the user to match residues found in various foods to the consumption of those foods by the U.S. population and by various subgroups of that population. The food consumption for these populations is taken from USDA's Continuing Survey of Food Intake by Individuals (CSFII), 1989-92 report. When residue data are input into DEEM™, estimated exposures are reported out both in terms of the absolute exposure (mg/kg/day) and exposure relative to the toxicological safety endpoint, i.e., as a percent of the PAD. Further information on dietary exposure assessment as it is performed by EPA is available at the EPA website at: www.epa.gov/fedrgstr/EPA-PEST/2000/July/Day-12/6061.pdf. Further information on the DEEM™ program is available at www.epa.gov/scipoly/sap/2000/February/Final_sap_document_Feb_1_2000.pdf.

Toxicological Information

Atrazine

For the chronic assessment an appropriate toxicological endpoint for atrazine for the general population, including females, infants and children, is available, and is listed in Table 1. For the acute (1-day) effects, the only relevant population subgroup in the acute exposure assessment is "females, 13-50 years old" (HIARC, 8/31/00, R. Hawks).

At a meeting of the CARC held on December 13, 2000, atrazine was classified as "Not Likely To Be Carcinogenic To Humans"(Hed Doc. No. 014431, CARC 12/13/2000, K. Baetke and V. Delarco) . Therefore, no cancer exposure assessment has been performed in this assessment.

The Food Quality Protection Act Safety Factor Committee (FQPA SFC) met on October 23, 2000 and November 8, 2000 to evaluate the hazard and exposure data for atrazine (including its chloro- and hydroxy-metabolites) in order to recommend the FQPA safety factor to be used when assessing the risks posed by the use of this chemical. The SFC concluded that the FQPA safety factor should be retained at 10X for the acute and chronic toxicological safety endpoints for atrazine and its chloro-metabolites (represented by DACT). For the hydroxy-metabolites of atrazine the FQPA safety factor has been removed, i.e., reduced to 1X (HED Doc. No. 014375, FQPA SFC 11/14/2000, B. Tarplee).

Table 1. Toxicological Safety Endpoints for Atrazine

<table>
<tr><th>EXPOSURE SCENARIO</th><th>DOSE (mg/kg/day)</th><th>ENDPOINT</th><th>STUDY</th></tr>
<tr><td rowspan="3">Acute Dietary</td><td>NOAEL= 10
UF = 100</td><td>Delayed ossification of certain cranial bones</td><td>Developmental toxicity study in the rat</td></tr>
<tr><td colspan="3">Acute RfD = 0.1 mg/kg/day Applies to Females 13-50 only</td></tr>
<tr><td colspan="3">[An FQPA safety factor of 10X has been retained for all relevant population subgroups in this assessment.]
Acute PAD = 0.01 mg/kg/day</td></tr>
<tr><td rowspan="3">Chronic Dietary</td><td>NOAEL = 1.8
UF = 100</td><td>Attenuation the pre-ovulatory lutenizing hormone (LH) surge</td><td>Six-month LH surge study in the rat</td></tr>
<tr><td colspan="3">Chronic RfD = 0.018 mg/kg/day. Applies to all population subgroups.</td></tr>
<tr><td colspan="3">[An FQPA safety factor of 10X has been retained for all population subgroups in this assessment.]
Chronic PAD = 0.0018 mg/kg/day</td></tr>
</table>

Hydroxyatrazine

HIARC did not select an acute toxicological endpoint for hydroxyatrazine because acute toxicological effects were not noted in any of the toxicological studies. For the chronic reference dose, a combined chronic/carcinogenicity study in rats was used. The uncertainty factor was 100 (from 10X for uncertainties due to intra-species variability and 10X due to inter-species variability) (HIARC, 8/28/00, R. Hawks). Hydroxyatrazine is not considered to possess carcinogenic potential. These results are shown in Table 2. For this assessment the 10X FQPA safety factor has been removed for the relevant chronic endpoint for hydroxy metabolites of atrazine. (While for the chloro-metabolites of atrazine, the chronic RfD was based on changes in luteinizing hormone (LH) levels, for hydroxy-atrazine the chronic RfD was based on gross kidney histopathological effects resulting from formation of hydroxy-crystals.)

Table 2. Toxicological Safety Endpoints for Hydroxy Metabolites of Atrazine

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT	STUDY
Acute Dietary	NOAEL= None selected	None selected	None selected
	Acute RfD = Not determined		
Chronic Dietary	NOAEL = 1.0 UF = 100	Renal alterations	Combined chronic toxicity/oncogencit y in the rat
	Chronic RfD = 0.01 mg/kg/day		
	[The FQPA safety factor is removed.] **Chronic PAD=0.01 mg/kg/day**		

Residue Information

Atrazine is 2-chloro-4-ethylamino-6-isopropylamino-s-triazine. Metabolism in plants occurs primarily via three routes: replacement of the 6-chloro- atom with a hydroxy group, replacement of the 6-chloro-atom with a glutathione conjugate, and loss of either or both N-alkyl groups. The HIARC has not recommended a toxicological endpoint for the glutathione conjugates and these metabolites are not addressed in this exposure assessment. The group of metabolites that retain the chloro-atom, including parent and the three metabolites formed by loss of either or both N-alkyl groups from the parent are assumed to have the same toxicological effects as the parent atrazine, so one assessment is performed on these four compounds summed together as a group. The HIARC has assigned a separate toxicological safety endpoint to hydroxyatrazine. The group of four hydroxy-metabolites, formed by replacement of the chloro-atom with a hydroxy-group plus loss of neither, either or both N-alkyl groups are assumed to have this same toxicological safety endpoint and have also been grouped together in this assessment.

CORN

Atrazine and Chlorinated Metabolites

Monitoring data were available for sweet corn. All results for all monitoring data were non-detects (NDs). While both the Pesticide Data Program (PDP) and the Food and Drug Administration (FDA) tested for atrazine in corn in their residue monitoring programs, both programs tested only for the parent atrazine and only tested sweet corn. Testing did not cover field corn, which is a much larger portion of the corn crop. In a special study in 1995, FDA also tested 26 samples of sweet corn for parent atrazine plus two of the metabolites, desethyl atrazine and desethyl simazine (a.k.a. desisopropyl atrazine), but did not test for the didesalkyl chloro-metabolite, diaminochlorotriazine (DACT). Unfortunately, in corn tissues DACT is expected to be the most predominant chloro-metabolite of atrazine. Regardless of the metabolites tested in this special study, the sampling was also too small to be useful in a risk assessment.

Numerous acceptable field trials exist for atrazine and its metabolites in field corn (MRIDs 44597602, 44315410, and 44152117), but all field trial results are NDs with a Limit of detection (LOD) of 0.05 ppm for atrazine and each chloro-metabolite of atrazine. There are also two corn metabolism studies that were conducted at different application rates of atrazine; one was conducted based on a post-emergent application at 3.0 lbs ai/A (1.2 X the maximum pre-emergent/post-emergent 2.5 lbs/A), and the other at a pre-emergent application rate of 2.0 lbs ai/A (1.0X the maximum pre-emergent 2.0 lbs/A) (1996; MRIDs 44315408 and 44152121). Both studies resulted in ND findings for residues of atrazine and its chlorinated metabolites in corn grain. However, the total radioactive residues (TRR) that would partition into an organic solvent were also quantified in these metabolism studies. TRR were measured at 0.0005 ppm (mean of 3 samples after adjustment to a 1X rate) for residues resulting from the post-emergent application and at 0.000185 ppm (one sample) from the pre-emergent application. If atrazine or any chloro-metabolites of atrazine were present in the corn grain, their combined residues are expected to be in this organic fraction. Since these TRR concentrations are well below the LODs reported in the field trials, the TRRs in the organic fractions were used to estimate the potential maximum combined residues of atrazine and its chlorinated metabolites in corn grain.

In support of this approach to estimating anticipated residues of atrazine and its chloro-metabolites in corn grain, Health Effects Division (HED) refers to memorandum CBRS 10980 (6/3/93, J. Abbotts). For the purposes of dietary risk assessment, and since use patterns on sweet corn and field corn are similar, and also since anticipated residues (ARs) in these corn grains have been identical (see 59 FR 60412, 11/23/94, PD1), residues from field corn can be translated to sweet corn when separate data on sweet corn are not available (MARC, J. Abbotts, 01/02/96). Although likely to be conservative, these metabolism study results were used in this dietary exposure assessment as the most sensitive residue information, and therefore the best residue information available for atrazine in both field corn and sweet corn. Although all results from monitoring of sweet corn grain had been NDs, and all field trials of all corn were NDs in the grain, there was inadequate information to set all results in all corn grain to zero, because there was no monitoring data on field corn grain, by far the larger grain crop.

To calculate ARs for atrazine and its chloro-metabolites in corn grain for dietary exposure assessment, information on the typical use patterns for atrazine on corn were considered. Typically, 70% of atrazine applications have been made pre-emergent, and 30% of the applications have been made 'post-emergent.' (More exactly, Novartis has reported that there are three different use scenarios: (i) 2.0 lbs ai/A pre-emergence treatment only, accounting for 70% of atrazine used on corn, (ii) 0.5 lbs ai/A pre-emergence treatment followed by 2.0 lbs ai/A post-emergence treatment, accounting for 22% of atrazine used on corn, and (iii) 1.5 lbs ai/A pre-emergence treatment followed by 1.0 lbs ai/A post-emergence treatment, accounting for 8% of atrazine used on corn. Thus 70% of atrazine is used on corn solely in pre-emergence treatments. Another 30% is used in corn in combined pre-emergence/post-emergence treatments.) The Biological and Economic Analysis Division (BEAD) has confirmed the 70:30 ratio of these treatment scenarios (D. Widawsky, 9/26/2000, e-mail to Catherine Eiden; Re: atrazine usage on guava, macadamia nuts, corn and sorghum). Based on this application timing information, the pre-emergent and 'post-emergent' residues were prorated according to the proportion of crop treated each way. From above, pre-emergent residues were at 0.000185 ppm and post-emergent residues at 0.0005 ppm. To calculate the chronic AR for atrazine and the chlorinated metabolites potentially in corn grain the following equation was used:

$$(0.0005 \text{ ppm})(0.30) + (0.000185 \text{ ppm})(0.70) = 0.0002795 \text{ ppm} \approx 0.00028 \text{ ppm}.$$

For field corn, Biological and Economic Assessment Division (BEAD) reported that, on average, 75% of the crop was treated, and at a maximum, 84% of the crop was treated with atrazine. Using this result, a point estimate was calculated for the chronic assessment for field corn at 0.00021 ppm (0.00028 ppm X 75%).

A point estimate was also used for the acute assessment because field corn is a blended commodity. The point estimate for acute assessment was calculated by applying 84% maximum percent crop treated (%CT) to the AR of 0.00028 ppm, as calculated above, to yield 0.00024 ppm. These point estimates were used for all field corn based foods, including popcorn, corn syrup, corn molasses, and corn oil.

It should be noted that, in their monitoring program, PDP has tested samples of high fructose corn syrup (HFCS) for atrazine. All results were NDs, but because the LOD of the PDP method was so much higher than the maximum estimated atrazine residues in corn grain from the metabolism studies, the metabolism data were used in the dietary assessment for HFCS rather than the PDP data.

A processing study (MRID 43160505) was available for processing corn to corn flour, corn starch, gluten, crude oil, refined oil, grits, meal, presscake and steepwater. In this study, however, residues in both the raw agricultural commodity (RAC) and the processed products were all ND for parent, all chloro-metabolites, and all hydroxy-metabolites except desethyl hydroxy-atrazine. Desethyl hydroxyatrazine was present in the RAC at 0.03 ppm and was ND in each of the processed products with an LOD of 0.02 ppm. However, when the desethyl hydroxyatrazine was combined with the ND findings for the other three hydroxy metabolites in the RAC, and compared to the ND findings for all four metabolites in the processed products (reduction of either 0.09 ppm to 0.08 ppm based upon LODs or of 0.06 ppm to 0.04 ppm based upon ½ LODs), the practical result was a processing factor not sufficiently different from 1.0.

Without good processing data for the food forms of corn consumed by humans, the DEEM™ default processing factor of 1.5X was used for both molasses and corn syrup. The DEEM™ default factor of 1.0X was used for corn oil, corn bran, corn flour.

For sweet corn, BEAD has reported that, on average, 50% of fresh sweet corn and 58% of processed sweet corn are treated with atrazine. The AR of 0.00028 ppm calculated above for corn was also used for sweet corn. The estimated maximum percent of crop treated (%CT) was 60% for fresh sweet corn and 65% for processed sweet corn. For the chronic assessment, the resulting point estimates were calculated to be 0.00014 ppm (0.50X 0.00028) for fresh sweet corn, 0.00016 ppm (0.58X 0.00028) for processed sweet corn. For the acute dietary exposure analysis, it was necessary to create Residue Data Files (RDFs) for sweet corn. (RDFs are files that allow residue information to be input into DEEM™ as a distribution, for probabilistic assessment, rather than as a point estimate.) This was necessary because fresh sweet corn is considered to be a not-blended commodity and processed sweet corn is considered to be a partially blended commodity. To create the RDF for fresh sweet corn, we returned to the fact that 70% of corn treated with atrazine is treated pre-emergent and 30% is treated 'post emergent.' To this we applied the BEAD estimate that a maximum of only 60% of the corn crop receives any treatment at all with atrazine. From this information an RDF was created for fresh sweet corn that consisted of 42 residues at 0.000185 ppm (pre-emergent), 18 residues at 0.0005 ppm ('post-emergent'), and 40 at zero. Because a maximum of 65% of processed sweet corn is treated with atrazine, a second RDF was created for processed sweet corn that consisted of 45 pre-emergent residues at 0.000185 ppm, 20 'post emergent' residues at 0.0005 ppm, and 35 residues at zero.

Hydroxy Metabolites

Because only a chronic dietary exposure assessment is required for the hydroxy metabolites of atrazine, only chronic ARs were estimated for the hydroxy-metabolites in corn. Residues of the hydroxy-metabolites were reported in eight samples from four field trials on corn. Only hydroxyatrazine and desethylhydroxyatrazine were assayed in these trials. All four field trials were treated at 3.0 lbs ai/A post-emergence. Results for both of the hydroxy-metabolites were all NDs in all eight samples (LOD = 0.02 ppm, ½ LOD = 0.01 ppm), except for one sample that contained 0.023 ppm of desethylhydroxyatrazine. The average of the combined residues of the two hydroxy-metabolites of atrazine in corn grain is 0.022 ppm. (This is the average of the 7 samples with combined ½ LOD residues of 0.02 ppm. and one sample with combined residues of 0.033 ppm [0.01 ppm + 0.023 ppm].) Because no pre-emergence field trial data were available, it was not possible to further adjust this value for the 70:30 pre-emergence:post-emergence ratio. Using this AR of 0.022 ppm for the chronic exposure to the hydroxy-metabolites in the diet, and incorporating average %CT information as noted above, the point estimates were 0.011 ppm for fresh sweet corn, 0.013 ppm for processed sweet corn, and 0.017 ppm for field corn.

SORGHUM

Table 1, of EPA's Residue Chemistry Guidelines, states that there is no U.S. consumption of sorghum. While sorghum is listed in DEEM™, consumption of sorghum was not reported in CSFII 1989-1992. Some small consumption of sorghum has been reported in CSFII 1994-1996 (D. Hrdy e-mail to David Soderberg 10/19/2000; consumption reported for sorghum in DEEM^{TM}). Because sorghum is listed in DEEM^{TM}, and because HED is expected to switch to use of CSFII 1994-1996 in the near future, sorghum residues were included in this assessment. All sorghum residues were calculated as residues on the grain. This appeared to be most consistent with DEEM^{TM}, which lists "boiled" sorghum as the only human food form.

Atrazine and Chlorinated Metabolites

No monitoring data from FDA or PDP were available for atrazine on sorghum. Although there were adequate field trials for sorghum (MRIDs 44597603 and 44315411), all analyses for atrazine and its chlorinated metabolites in sorghum grain in these field trials showed ND residues (< 0.05 ppm). Therefore, as with corn, the more sensitive "organic phase" TRR results from two metabolism studies on sorghum grain (1996; MRIDs 44315409 and 44152120) were used in place of the field trial data to provide a more accurate estimate of the residues. Although atrazine and its chloro-metabolites could not be detected and quantified specifically in these metabolism studies, the organic phase TRR is expected to contain the residues of atrazine and its chlorinated metabolites. The residues measured as TRR in this organic phase were 0.0027 ppm and 0.00034 ppm, respectively, for post- and pre-emergent applications extrapolated to 1X application rates. These results were used to calculate ARs for sorghum grain commodities in the diet. Typically atrazine applications to sorghum are split 75:25 pre- and 'post-emergent,' respectively (in pre-emergence and combined pre-/post-emergence scenarios similar to those for corn) (D. Widawsky, 9/26/2000, e-mail to Catherine Eiden; Re: atrazine usage on guava, macadamia nuts, corn and sorghum). Taking this use information into account the AR for atrazine and its chlorinated metabolites in sorghum grain were calculated as follows:

$$(0.0027\text{ ppm})(0.25) + (0.00034\text{ ppm})(0.75) = 0.00093\text{ ppm}.$$

BEAD estimated that on average 59% of the sorghum crop was treated with atrazine and a maximum of 74% of the crop was treated. Because sorghum commodities are blended, the average %CT was used to create a point estimate at 0.00055 ppm (0.59X 0.00093) for the chronic assessment. For the acute assessment, 0.00093 ppm was multiplied by the maximum 74% CT to yield 0.00069 ppm.

A processing study (MRID 43160503) was available for processing of sorghum grain into decorticated grain, small grits, large grits, bran and flour. The only food form of sorghum in DEEM^{TM}, however, is boiled sorghum grain, so the sorghum processing study is not applicable to this dietary exposure assessment.

Hydroxy Metabolites

No field trial data were available for the hydroxy-metabolites in sorghum. Therefore, for the chronic assessment of hydroxy atrazine residues in sorghum grain, an AR value was estimated from the results of the sorghum metabolism studies. In these metabolism studies, combined residues of the four hydroxy-atrazine metabolites were detected and quantified at 0.0085 ppm in samples treated post-emergent at a 1X rate, and at 0.0005 ppm from samples treated pre-emergent at a 1X rate. The AR for atrazine hydroxy metabolites was calculated as follows:

$$(0.0085 \text{ ppm})(0.25) + (0.0005 \text{ ppm})(0.75) = 0.0025 \text{ ppm}.$$

Incorporating the average 59% crop-treated information, the point estimate for chronic dietary assessment of hydroxy atrazine metabolites in sorghum is 0.001475 ppm.

SUGARCANE

Atrazine and Chlorinated Metabolites

No monitoring results for atrazine in sugarcane were available from PDP or FDA. Field trials were available that showed all ND (<0.001) results in the RAC sugarcane treated at 0.8X to 2X application rates (1994; MRID 43160504). However, sugarcane is rarely consumed directly, the vast majority of the crop is refined into sugar or molasses before consumption. In order to incorporate information on processing into refined sugar and molasses, the results of a processing study in which sugarcane was processed after a 1X treatment (PHI 119 days) were used (1994; MRID 43395504). The sugar was tested for atrazine and each of its chloro-metabolites. No residues of atrazine or any of it's chloro-metabolites were detected at LODs of 0.001 ppm. Therefore, the ½ LOD of 0.0005 ppm in this method for atrazine combined with each of its 3 chlorinated metabolites at 0.0005 ppm was used to estimate residues for acute and chronic dietary assessment (0.0005 ppm x 4 = 0.002 ppm). BEAD estimated that a maximum of 95% of the sugar crop, and an average 76%, is treated with atrazine. A point estimate was calculated at 0.0015 ppm (0.002 X 0.76) for the chronic exposure estimate for refined sugar. Sugar is a blended commodity, so for the acute exposure estimate the residue of 0.002 ppm was multiplied by the maximum 95% CT to yield a point estimate of 0.0019 ppm.

Molasses is also a blended commodity. For molasses from the same study, all residues were non-detectable at a LOD of 0.05 ppm. ARs were estimated by summing ½ the LOD (0.025 ppm) for each of the chloro-metabolites and the parent compound for a total of 0.100 ppm for the combined residues of atrazine and chloro-metabolites. For the chronic assessment, using the average 76% CT, atrazine was given a point estimate of 0.076 ppm. For the acute assessment, based upon the maximum 95% CT, atrazine was given a point estimate of 0.095 ppm. No processing factors were applied to molasses or sugar because residues were tested directly in the processed commodity.

Hydroxy Metabolites

For the chronic assessment for hydroxy atrazine a value was estimated from a measurement in sugarcane molasses of 0.03 ppm. This value was used for the molasses without a concentration factor. For the chronic assessment 0.03 ppm was multiplied by 76% CT to get 0.023 ppm in molasses.

No information on the hydroxy-metabolites in refined sugar was available, so a rough estimate was extrapolated from the molasses residue. A separate processing study using fortified sugarcane was described in the Oct 18, 1988 Registration Standard Document as showing that residues of atrazine, per se, concentrated 6X in molasses compared to <1X in refined sugar. Therefore an expected concentration factor of 6X for molasses compared to sugar was used. Although this factor was determined from measurements of only the parent atrazine, it was used in this assessment for the hydroxy-metabolites as the best available information for estimation of atrazine metabolites in refined sugar. This factor is conservative both because the hydroxy-metabolites are expected to be more hydrophillic than parent atrazine (hence more easily removed during sugar refining) and because it overestimates the amount of parent atrazine in refined sugar. Using this concentration factor, and the average 76% CT, the residues in sugar were estimated at 1/6 the molasses residue, or 0.03/6 X 0.76 = 0.004 ppm.

WHEAT

Atrazine and Chlorinated Metabolites

A tolerance exists for atrazine, parent only, in wheat grain at 0.25 ppm. Atrazine is not applied to wheat directly except to residual wheat stubble prior to a fallow period. Wheat is planted in rotation with corn and sorghum that have been treated with atrazine. A limited crop rotation study has shown residues of atrazine present in wheat harvested 7 - 10 months after treatment of a corn crop. In routine sampling, USDA's PDP program has also found residues of atrazine in wheat in its testing program. Therefore, although there are no direct treatments of wheat with atrazine, wheat can be a source of residues of atrazine and must be included in this dietary exposure assessment.

Adequate field trials were available for wheat (1994; MRID 43160502) , but all results in the wheat grain in these trials were NDs. There were also monitoring results available from PDP for parent atrazine (only) in wheat for the years 1995-1997. During these years PDP tested 1563 samples of wheat with an LOD of 0.002 ppm, and found 27 samples that contained detectable residues of parent atrazine at concentrations ranging from 0.003 ppm to 0.031 ppm. The 27 detectable residues averaged 0.0051 ppm and summed to 0.138 ppm. No metabolism study had been performed on wheat because the corn metabolism study was considered adequate to represent wheat. Therefore, because parent atrazine was not detected in corn grain in the corn metabolism studies, no grain metabolism information was available that could be used to extrapolate the PDP results for parent atrazine in wheat grain to the total chloro-metabolites in wheat grain. Atrazine and its chloro-metabolites had all been measured in field trials in wheat forage, so these field trial results providing metabolism information in forage were used to create ratios of each metabolite to parent. These ratios were then used as the best information available to estimate total chloro-metabolites in wheat grain based upon the PDP results for parent atrazine.

More specifically, the field trial data on fall and spring wheat forage was used to create these ratios of metabolites to parent. In some of these trials there were measurable amounts of atrazine, desethylatrazine and DACT. Desisopropyl-atrazine was ND in all trials. Ratios of desethylatrazine and DACT to atrazine were calculated from these measurements and desisopropylatrazine was assumed to be contribute no residues. The ratios for desethylatrazine and DACT agreed well across all of the samples that had quantifiable residues. When calculating these ratios, the molecular weight ratios of desethylatrazine and DACT to atrazine were also incorporated in order to adjust the ratios from weight ratios to molar equivalent ratios.

The weight ratio of desethylatrazine residues to atrazine residues is 1.4X for both spring and fall forage. To calculate desthylatrazine in molar equivalents of atrazine, 1.4X is adjusted by 216/188 to yield 1.6X. The weight ratio for DACT to atrazine is 0.4X in fall forage and 1.25X in spring forage. BEAD has estimated that the crop ratio of fall forage (winter wheat) to spring forage (spring wheat) is 17 to 6 (D. Widawsky, e-mail to David Soderberg, 10/13/2000; Re: atrazine - wheat). Therefore the overall average weight ratio of DACT to atrazine is (17 x 0.4 + 6 x 1.25)/23 = 0.62X. Corrected to atrazine molar equivalents, the 0.62X is adjusted by the molecular weight ratio 216/146 to yield 0.92X.

Using these two values, plus 1X for atrazine and 0X for desisopropylatrazine, the total chloro-metabolite residues are calculated as the sum of these four factors times the atrazine residues measured by PDP. Specifically, the total chloro-metabolites = 1.6X atrazine + 0.92X atrazine + 0X atrazine + 1.0X atrazine = 3.52X atrazine. This value was used to convert all residues measured in wheat grain as atrazine to residues expressed as chloro-metabolites.

BEAD estimated that, on average less than 1% of the wheat crop is treated with atrazine; at a maximum 1% of the crop is treated with atrazine. This is actually treatment to wheat stubble prior to a fallow period. However, using this value of 1% CT is not likely to provide a conservative estimate of residues on wheat, because wheat is also grown in rotation with corn and sorghum that have been treated with atrazine, and residues may arise from this crop rotation. The 1% applied to wheat stubble is used simply because it is the best estimate available to HED.

For the chronic assessment an average residue point estimate was calculated. Of 1563 total wheat samples tested for atrazine, 27 samples, or about 1.7%, had positive findings for atrazine. Because the proportion of actual detects (1.7%) exceeded the proportion of theoretical detects (1%), all NDs were assumed to be zero. (In such cases the exact value of the estimated percent of the crop treated is moot so long as it is less then the percentage actually found to be treated.) The average residue for the chronic assessment then is the total of the detected residues (0.138 ppm, see above), plus zero for all non detects, divided by the total number of samples (1563), and then multiplied times the 3.52 factor to convert measured atrazine residues to a sum of all chloro-metabolites.

$$[(0.138)/1563] \times 3.52 = 0.00031 \text{ ppm.}$$

For the acute assessment for wheat grain an RDF was created. Since wheat is a blended commodity, none of the NDs for the acute assessment could be assumed to be at zero, regardless of % CT, so the 1536 NDs were assumed to be at 3.52X the ½ LOD of 0.001 ppm = 0.00352 ppm. Each of the 27 positive findings was also multiplied by the 3.52 factor and entered into the RDF, creating an RDF of 27 positive findings ranging from 0.01 ppm up to 0.1 ppm plus 1536 results at 0.00352 ppm.

Wheat germ oil, wheat flour, wheat bran and wheat germ are all processed forms of wheat and were given a point estimate in the acute assessment. As was the average % CT used for the chronic estimate, the maximum % CT is less than the percent of samples actually found positive, therefore the acute point estimate for these commodities is also (0.138/1563) x 3.52, or 0.00031 ppm, the same as the value calculated for wheat commodities for chronic exposure.

A processing study was available for atrazine in wheat. However, atrazine, all chloro-metabolites and all hydroxy-metabolites are reported to be ND in the grain and in all products processed from the grain in this study. Therefore this study was not applicable to this assessment and all wheat products were calculated using the DEEM™ default processing factors of 1.0 for all wheat food forms.

Hydroxy Metabolites

For the chronic hydroxyatrazine assessment the ratio of hydroxy-metabolite residues in wheat forage to parent atrazine in wheat forage, estimated from field trials (1994; MRID 43160502), was used to convert the residues of atrazine found in the PDP monitoring to hydroxy-metabolite residues. Over an average of 8 field trials (MRID 43160502), the sum of hydroxy-metabolites of atrazine, corrected to hydroxyatrazine molar equivalents of atrazine was just about equal to the amount of parent found present. Specifically, hydroxy atrazine was present at a weight ratio to atrazine of 0.226, desethylhydroxyatrazine was present at a weight ratio to atrazine of 0.606 and residues of desisopropylhydroxyatrazine and diaminohydroxy-s-triazine were not detected. The sum of the ratios for the hydroxy-metabolite residues, adjusted to molar ratios to atrazine, was thus: 0.226 x 216/197 X atrazine + desethyl hydroxyatrazine at 0.606 x 216/170X atrazine + 0X for desisopropyl hydroxyatrazine + 0X for diaminohydroxy-s-triazine = 1.02X atrazine. Therefore, the residues for parent atrazine found by PDP in wheat grain were used without correction to estimate the amount of residues of hydroxy-metabolites found in wheat grain. As above, the % CT reported by BEAD was 1%. This resulted in a point estimate for the chronic assessment (from 0.138/1563, see above) at 0.000088 ppm.

MACADAMIA NUTS

Atrazine and Chlorinated Metabolites

There were no monitoring data for macadamia nuts, but there were field trials (MRID 40413418). The field trials were all ND with an LOD of 0.05 ppm for atrazine and for each of the three chloro-metabolites. Summing these led to an estimate for the LOD for the combined atrazine plus chloro-metabolites at 0.2 ppm, or a ½ LOD at 0.1 ppm. BEAD estimated that 57% of the macadamia crop has been treated with atrazine (Quantitative Usage Analysis for Atrazine, D. Widawsky, 1/10/2001). The ½ LOD of 0.1 ppm was used with 57% CT to yield a residue of 0.057 ppm for the chronic chloro-metabolite assessment. Macadamia nuts are considered to be partially blended, so for the acute assessment an RDF was created that consisted of 57 values at 0.10 and 43 results set to zero.

Hydroxy Metabolites

No field trial data were available for the hydroxy-metabolites of atrazine in macadamia nuts, so the macadamia tolerance of 0.25 ppm was used for the chronic hydroxy-assessment. At 57% CT this resulted in an estimated residue of 0.1425 ppm.

GUAVA

Atrazine and Chlorinated Metabolites

There were existing field trials for guava (MRID 40413418) in which parent compound atrazine was tested, but there were no field trials where any of the chlorinated metabolites or hydroxy atrazine were tested. There were also no monitoring data for atrazine in guava and BEAD had little information on the percent of the crop that was treated with atrazine. Therefore the tolerance for atrazine in guava of 0.05 ppm was used with a value of 10% CT that had been estimated by Novartis and that was supported by BEAD (D. Widawsky, 9/26/2000, e-mail to Catherine Eiden; Re: atrazine usage on guava, macadamia nuts, corn and sorghum). Guava are considered to be not blended. For the acute assessment this resulted in an RDF that consisted of one value at 0.05 and 9 results set to zero. It resulted in a residue of 0.005 ppm for the chronic parent plus chloro-metabolite assessment. The value for guava was also applied to guava juice without a processing factor.

Hydroxy Metabolites
Lacking any information for the hydroxy-metabolites on guava, the estimated residue of 0.005 ppm, used in the chronic assessment for atrazine and its chloro-metabolites was also used for the chronic hydroxy-assessment.

MILK

In 1997, 1998 PDP tested 1892 samples of milk for atrazine (parent only). All samples were NDs at an average LOD of 0.0075 ppm. Since all results were NDs, more refined estimates were calculated using mass balance estimates using residues found in feed crops and animal feeding and metabolism studies.

Atrazine and Chlorinated Metabolites
To calculate chronic exposure to atrazine and its chloro-metabolites in milk, a dairy cattle dietary burden was calculated based upon a diet of 50% field corn forage (note that > 99% of corn forage fed is from field corn), 40% corn grain and 10% molasses. This was then compared to a dairy cattle feeding and metabolism study (MRID 40431424), which is further discussed in Appendix A to this document. Table 3 shows the information available for calculating dietary burden in dairy cattle from field corn forage, corn grain, and molasses, and also shows the estimated total dietary burden.

Table 3. Table of Data for Crops Used for Estimation of Dietary Burden of the Chloro-metabolites of Atrazine in Dairy Cows

Commodity	Mean Field Trial Chlorotriazine Residue (ppm)	Mean % Crop-Treated	%CT-Adjusted Residue	% Dry Matter	Fraction of the Diet	Chronic Dietary Burden of Chloro-triazines (ppm)	Acute Dietary Burden of Chloro-triazines (ppm) (no % CT)
Field Corn Forage	0.0412	75	0.031[a]	48	0.50	0.032[b]	0.0429[c]
Corn Grain	0.00028	75	0.00021[a]	88	0.40	0.00095[b]	0.00013[c]
Molasses	0.10	76	0.076[a]	75	0.10	0.01[b]	0.0133[c]
Total						0.043[d]	0.056[d]

a. Adjusted Residue = Mean Field Trial residue x % crop treated ÷ 100
b. Chronic Dietary Burden = Adjusted Residue x Fraction of Diet x 100 ÷ % Dry Matter
c. Acute Dietary Burden = Mean Field Trial x Fraction of Diet x 100 ÷ % Dry Matter
d. Total Dietary Burden = Field Corn + Corn Grain + Molasses

The anticipated residues on corn grain and molasses in Table 3 are the same as those described above under "CORN" and under "Sugarcane." Residues on corn forage for Table 3 were estimated from field trial data as follows. As described earlier, results were available from field trials that were conducted under three different atrazine treatment scenarios: (i) 0.5 lbs ai/A pre-emergence treatment followed by 2.0 lbs ai/A post-emergence,

(ii) 2.0 lbs ai/A pre-emergence treatment only, and (iii) 1.5 lbs ai/A pre-emergence treatment followed by 1.0 lbs ai/A post-emergence. (Data for corn forage from these studies are presented in Appendix B.) According to Novartis, treatment (i) accounts for 22% of atrazine used on corn, treatment (ii) accounts for 70% of atrazine used on corn, and (iii) accounts for 8% of atrazine used on corn. BEAD has confirmed that approximately 70% of atrazine is used in scenario (ii) and approximately 30% of atrazine is used in scenarios (i) and (iii) combined. (D. Widawsky, 9/26/00, e-mail to Catherine Eiden; Re: Atrazine on guava, macadamia nuts, corn and sorghum). Residues of atrazine and the chloro-metabolites were measured in samples taken at a 30-day PHI from multiple field trials treated under scenarios (i) and (iii), and in samples taken at a 60-day PHI treated under scenario (ii). All samples with non-detectable residues (< 0.01 ppm) in these studies were included as ½ of the LOD (0.005 ppm). Measured residues of the three chloro-metabolites of atrazine were adjusted to the molar equivalents of atrazine. Then the residues of parent atrazine and its three metabolites were summed together, and these sums were averaged within each treatment scenario. This is shown in Tables B1 - B3. These averages were then combined across application scenarios using the 22:70:8 ratio of application scenarios described above. This resulted in a calculation for atrazine and its chloro-metabolites in corn forage as follows:

$$[(0.0841 \text{ ppm})(0.22) + (0.0268 \text{ ppm})(0.70) + (0.0490 \text{ ppm})(0.08)] = 0.0412 \text{ ppm}$$

The AR for corn forage so calculated, 0.0412 ppm, was adjusted for percent crop treated and percent dry matter, and was combined with the residues from corn grain and molasses as shown in Table 3, to provide an estimate of the chronic theoretical dietary burden (TDB) of atrazine and chloro-metabolites fed to dairy cattle. The resulting estimated chronic TDB for dairy cattle, shown in Table 3, is 0.043 ppm. As described in Appendix A, the cattle in the feeding and metabolism study were dosed at 3.75 ppm, or 87X this TDB. For the chronic exposure assessment these animals produced milk containing an average of 0.0446 ppm of the combined residues of atrazine and its chloro-metabolites (as molar equivalents of atrazine). Thus, for the assessment of chronic exposure to parent and chloro-metabolites an AR in milk was calculated as 0.0446 ppm/87 = 0.0005 ppm. This result was used for all milk food forms.

To calculate ARs for acute dietary assessment of atrazine and the chloro-metabolites in milk, average residues and the same diet as used above to estimate TDB for chronic dietary assessment was used, but percent of crop-treated information was not included per HED memorandum “Clarification of AR Calculation for Meat/Milk in Acute Assessments”, 10/14/99, D. Miller. The TDB, excluding % CT information, for acute dietary assessment for milk was 0.056 ppm (1X), as shown in Table 3. This represents 1/67X the lowest feeding level used in the feeding and metabolism study of 3.75 ppm, which produced residues in milk at 0.0409 ppm as explained in Appendix A. The acute AR for milk was therefore estimated to be 0.0409 ppm/67 = 0.0006 ppm. This result was used for all milk food forms. For acute assessment the AR of 0.0006 was then used to create an RDF using the 84% maximum %CT for corn. Thus the RDF consisted of 84 values at 0.0006 ppm and 16 values at zero.

Hydroxy Metabolites

For the purposes of this dietary assessment, a situation of exists for category 180.6(a)3, “no reasonable expectation of finite residues” of the hydroxy-metabolites of atrazine in cattle, sheep, horses and goats (see the Atrazine RED, Residue Chemistry Chapter). This determination has been based on non-detectable residues in these tissues at an exaggerated feeding level in animal feeding and metabolism studies.

MEAT (Cattle, Sheep, Horses and Goats)

Atrazine and Chlorinated Metabolites

For the chronic assessment for atrazine and the chloro-metabolites in red meat, a TDB was calculated using a beef cattle diet of 40% corn forage, 50% corn grain and 10% molasses. Residues in corn forage were estimated from the same data in appendix B as described above, under "MILK." These were then adjusted for percent crop treated, percent dry matter, and were combined by fractions of the diet as shown in Table 4. As before, the residues in corn grain and molasses are the same as those estimated in the appropriate crop sections above.

Table 4. Table of Data for Estimation of Chloro-metabolites of Atrazine in Beef Cattle, Sheep, Horses and Goats for the Chronic Assessment

Commodity	Mean Field Trial Chlorotriazine Residue (ppm)	Mean % Crop-Treated	%CT-Adjusted Residue	% Dry Matter	Fraction of the % Diet	Dietary Burden of Chloro-triazines (ppm)
Field Corn Forage	0.0412	75	0.031	48	0.40	0.026
Corn Grain	0.00028	75	0.00021[a]	88	0.50	0.00012[b]
Molasses	0.10	76	0.076[a]	75	0.10	0.01[b]
					Total	0.036[c]

a. Adjusted Residue = Mean Field Trial residue x % crop treated ÷ 100

b. Chronic Dietary Burden = Adjusted Residue x Fraction of Diet x 100 ÷ % Dry Matter

c. Total Dietary Burden = Field Corn + Corn Grain + Molasses

The TDB estimated in Table 4 for chronic dietary exposure assessment in meat is 0.036 ppm. This is 1/104X the lowest feeding level in the cattle studies (3.75 ppm), as described in Appendix A. ARs for kidney and muscle were based on residues detected in samples from feeding and metabolism studies at the 3.75 ppm dosing level. All non-detectable residues were included in the calculations as ½ the LOD (0.005 ppm). The ARs estimated in kidney and muscle, respectively, for chronic dietary exposure assessment are 0.0003 ppm and 0.0003 ppm. ARs in fat and liver, for the chronic assessment, are based upon all ND (<0.01 ppm) residues for all metabolites in all samples at the 3.75 ppm feeding level. The As shown in Appendix A, ARs were calculated by summing ½ LOD (0.005) for atrazine and each chloro-metabolite and dividing by 104. The resulting AR for liver was 0.0002 ppm and was also 0.0002 ppm for fat.

For acute exposure, the AR for atrazine plus chloro-metabolites in field corn forage fed to beef cows was based on the highest average field trial residue (HAFT). The HAFT for atrazine and its chloro-metabolites in 2 corn forage samples from the field trial with the highest residues was 1.107 ppm and 0.215 ppm, averaging to 0.66 ppm. (This is from corn treated 0.5 lbs ai/A pre-emergent and 2.0 lbs ai/A post-emergent with a 60 PHI. See appendix B.) The resulting AR was therefore 0.66 ppm calculated per HED memorandum, "Clarification of AR Calculation for Meat/Milk in Acute Assessments", 10/14/99, D. Miller.

The TDB for acute dietary exposure assessment of atrazine and the chloro-metabolites in meat was therefore estimated as shown in Table 5.

Table 5. Table of Data for Estimation of Chloro-metabolites of Atrazine in Beef Cattle, Sheep, Horses and Goats for the Acute Assessment

Commodity	Highest Average Field Trial Chlorotriazine Residue (ppm)	% Dry Matter	Fraction of the Diet	Acute Dietary Burden of Chloro-triazines (ppm)
Field Corn Forage	0.66	48	0.40	0.55[a]
Corn Grain	0.00028	88	0.50	0.0002[a]
Molasses	0.10	75	0.10	0.01[a]
			Total	0.56[b]

a. Acute Dietary Burden = Highest Average Field Trial x Fraction of Diet x 100 ÷ % Dry Matter
b. Total Acute Dietary Burden = Field Corn + Corn Grain + Molasses

The TDB is 0.56 ppm, or 1/6.7X 3.75 ppm, the lowest feeding level in the animal feeding and metabolism studies.

As described in Appendix A, when cows were fed feed containing atrazine at 3.75 ppm, the maximum residues in the kidney were 0.0357 ppm. Therefore, cows fed feed containing 0.56 ppm atrazine are expected to have 0.0053 ppm atrazine (0.0357/6.7) in their kidneys. The highest %CT is corn, at a maximum of 84% CT. For the acute assessment, therefore, an RDF was created for beef kidney that consisted of 16 results at zero and 84 results at 0.0053 ppm.

As shown in Appendix A, when cows were fed feed containing atrazine at 3.75 ppm, the maximum residues in the muscle were 0.045 ppm in loin and 0.02 ppm (½ LOD for parent plus chloro-metabolites) in round. Based on the highest residue at day 28 in loin and round and an average of the residues in these meat cuts, an acute AR of 0.0325 ppm is estimated. Using these results, cows fed feed containing 0.56 ppm atrazine are expected to have 0.0049 ppm (0.0325 x 0.56/3.75) atrazine in their muscle. The highest %CT is corn, at a maximum of 84% CT. Therefore an RDF was created for muscle that consisted of 16 zeros and 84 results at 0.0049 ppm.

In fat and liver residues of atrazine and the chloro-metabolites shown in Appendix A were all NDs (<0.01 ppm) in all samples at the 3.75 ppm feeding level. Therefore, ½ LODs (0.005 ppm) for atrazine and each of the three chloro-metabolites were summed to 0.02 ppm. The resulting acute ARs were 0.003 ppm in fat and 0.003 ppm in liver (0.02 x 0.56/3.75). RDFs were created that consisted of 16 zeros and 84 values set at 0.003 ppm for fat and liver, each.

<u>Hydroxy Metabolites</u>
For the purposes of this dietary assessment, a situation of exists for category 180.6(a)3, “no reasonable expectation of finite residues” of the hydroxy-metabolites of atrazine in cattle, sheep, horses and goats (see the

Atrazine RED, Residue Chemistry Chapter). This determination has been based on non-detectable residues in these tissues at an exaggerated feeding level in animal feeding and metabolism studies.

HOGS

For the purposes of this dietary assessment, a situation of exists for category 180.6(a)3, "no reasonable expectation of finite residues" of atrazine and the chloro-metabolites in hogs (Chem SAC memorandum, 10/11/00). This determination has been based on non-detectable residues in these tissues at an exaggerated feeding level in animal feeding and metabolism studies.

POULTRY (CHICKENS, TURKEYS, ETC) AND EGGS

For the purposes of this dietary assessment, a situation of exists for category 180.6(a)3, "no reasonable expectation of finite residues" of atrazine and the chloro-metabolites in poultry and eggs (Chem SAC memorandum, 10/11/00). This determination has been based on non-detectable residues in these tissues at an exaggerated feeding level in animal feeding and metabolism studies.

SUMMARY TABLES

Tables 6 and 7, below, summarize the residue information for the various commodities from the discussion above.

Table 6. Summary of Residue Data for the Chloro-metabolites of Atrazine on Foods.

Food	Tolerance (ppm)	% Crop Treated	Processing Factor	Food Type (NB, PB or B)[a]	Source of Data	Data Used in Chronic Assessment	Data used in Acute Assessment
field corn grain	0.25	max = 84% ave = 75%	1.0 DEEM™ default	B	metabolism study	0.00021	0.00024
corn bran		ditto	ditto	B	ditto	0.00021	0.00024
corn flour		ditto	ditto	B	ditto	0.00021	0.00024
corn oil		ditto	ditto	B	ditto	0.00021	0.00024
corn syrup		ditto	1.5 DEEM™ default	B	ditto	0.00021	0.00024
corn syrup molasses		ditto	1.5 DEEM™ default	B	ditto	0.00021	0.00024
fresh sweet corn	0.25	max = 60% ave = 50%	1.0 DEEM™ default	NB	ditto	0.00014	RDF atz-frshswcorn
processed sweet corn		max = 65% ave = 58%	ditto	PB	ditto	0.00016	RDF atz-procswcorn
sorghum grain	0.25	max = 74% ave = 59%	ditto	B	ditto	0.00055	0.00069
sugarcane sugar	0.25 on RAC	max = 95% ave = 76%	use residues directly after processing	B	field trial/processing study	0.0015	0.0019
sugarcane molasses		ditto	use residues directly after processing	B	field trial/processing study	0.076	0.095
wheat grain	0.25	max = 1% ave = 1%	ditto	B	PDP	0.00031	RDF atzwheatpdp2
wheat bran		ditto	ditto	B	ditto	0.00031	0.00031
wheat germ oil		ditto	ditto	B	ditto	0.00031	0.00031
wheat flour		ditto	ditto	B	ditto	0.00031	0.00031

Food	Tolerance (ppm)	% Crop Treated	Processing Factor	Food Type (NB, PB or B)[a]	Source of Data	Data Used in Chronic Assessment	Data used in Acute Assessment
wheat germ		ditto	ditto	B	ditto	0.00031	0.00031
macadamia nuts	0.25	57%	ditto	PB	field trials	0.057	RDF atz_macad
guava	0.05	10%	ditto	NB	tolerance	0.005	RDF atz_guava
guava juice		ditto	ditto	PB	ditto	0.005	RDF atz_guava
beef muscle	0.02	max = 84% ave = 75% (corn)	ditto	PB	AR calculated	0.0003	RDF atz_beef
dried beef		ditto	1.92 DEEM™ default	PB	ditto	0.0003	RDF atz_beef
beef liver		ditto	1.0 DEEM™ default	PB	ditto	0.0002	RDF atzbeeflivfat
beef kidney		ditto	ditto	PB	ditto	0.0003	RDF atz-beefkidney
beef fat	0.02	ditto	ditto	PB	ditto	0.0002	RDF atzbeeflivfat
beef meat byproducts	0.02	ditto	ditto	PB	ditto	0.0003	RDF atz-beefkidney
beef other organs		ditto	ditto	PB	ditto	0.0003	RDF atz-beefkidney
milk		ditto	ditto	PB	ditto	0.0005	RDF atz_milk
sheep	0.02	data from beef tissues are used for sheep tissue					
goats	0.02	data from beef tissues are used for goats tissue					
horses	0.02	data from beef tissues are used for horse tissue					
veal	N/A	data from beef tissues are used for veal tissue					

a. Non-blended (NB), Partially blended (PB), and Blended (B)

Table 7. Summary of Residue Data for the Hydroxy-metabolites of Atrazine on Foods.

Food	% Crop Treated	Processing Factor	Food Type (NB, PB or B) [a]	Source of Data	Data Used in Chronic Assessment
field corn grain	max = 84% ave = 75%	1.0 DEEM ™ default	B	field trial	0.017
corn bran	ditto	ditto	B	ditto	0.017
corn flour	ditto	ditto	B	ditto	0.017
corn oil	ditto	ditto	B	ditto	0.017
corn syrup	ditto	1.5 DEEM ™ default	B	ditto	0.017
corn syrup molasses	ditto	1.5 DEEM ™ default	B	ditto	0.017
fresh sweet corn	max = 60% ave = 50%	1.0 DEEM ™ default	NB	ditto	0.011
processed sweet corn	max = 65% ave = 58%	ditto	PB	ditto	0.013
sorghum grain	max = 74% ave = 59%	ditto	B	ditto	0.001475
sugarcane sugar	max = 95% ave = 76%	use residues directly after processing	B	field trial/processing study	0.004
sugarcane molasses	ditto	use residues directly after processing	B	field trial/processing study	0.023
wheat grain	max = 1% ave = 1%	ditto	B	PDP	0.000088
wheat bran	ditto	ditto	B	ditto	0.000088
wheat germ oil	ditto	ditto	B	ditto	0.000088
wheat flour	ditto	ditto	B	ditto	0.000088
wheat germ	ditto	ditto	B	ditto	0.000088
macadamia nuts	57%	ditto	PB	field trials	0.1425
guava	10%	ditto	NB	tolerance	0.005
guava juice	ditto	ditto	PB	ditto	0.005

a. Non-blended (NB), Partially blended (PB), and Blended (B)

Results and Discussion

As previously summarized, acute and chronic dietary exposure assessments were performed for atrazine and its chloro-metabolites. In addition, a chronic dietary exposure assessment was performed for the hydroxy-metabolites of atrazine. For all three exposure assessments, all population subgroups had exposures below their respective PADs. The only relevant population subgroup in the acute exposure assessment was "females 13-50 years old," exposed at <1% of the aPAD. The most highly exposed subgroup for chronic exposure assessment was "children, 1 - 6 years old," exposed at <1% of the cPAD for atrazine and its chloro-metabolites. "Children, 1 - 6 years old" were also exposed at <1% of the cPAD for the hydroxy-metabolites of atrazine. The results of these three assessments are tabulated below.

Table 8. Results of the Acute Assessment for Atrazine and its Chloro-Metabolites

Population Subgroup	Exposure at 95% (mg/kg/day)	Exposure at 95% (%aPAD)	Exposure at 99% (mg/kg/day)	Exposure at 99% (%aPAD)	Exposure at 99.9% (mg/kg/day)	Exposure at 99.9% (%aPAD)
Females 13-50	0.000017	<1.0	0.000025	<1.0	0.000041	<1.0

Table 9. Results of the Chronic Assessment for Atrazine and its Chloro-Metabolites

Population Subgroup	Exposure mg/kg/day	Exposure %cPAD
General Population	0.000005	<1.0
Infants	0.000008	<1.0
Children 1-6	0.000017	<1.0
Children 7-12	0.000009	<1.0
Females 13-50	0.000003	<1.0
Males 13-19	0.000006	<1.0
Males 20+	0.000003	<1.0
Seniors	0.000003	<1.0

Table 10. Results of the Chronic Assessment for the Hydroxy-Metabolites of Atrazine

Population Subgroup	Exposure mg/kg/day	Exposure %cPAD
General Population	0.000025	<1.0
Infants	0.000056	<1.0
Children 1-6	0.000059	<1.0
Children 7-12	0.000045	<1.0
Females 13-50	0.000019	<1.0

Population Subgroup	Exposure mg/kg/day	Exposure %cPAD
Males 13-19	0.000032	<1.0
Males 20+	0.000018	<1.0
Seniors	0.000014	<1.0

Uncertainties

There was adequate information about atrazine chloro-residues in all of the major crops, but it must be noted that only very limited data of any kind was available for guava and macadamia nuts. Virtually all of the information for these latter two crops is uncertain, but neither of these two crops contributes much to overall dietary exposure. Sensitivity analyses showing the effects of removing these two crops from the exposure assessments altogether had almost no effect. There was adequate information to estimate residues in meat and milk using mass balance procedures, but these estimates are expected to be conservative.

The only monitoring data available from PDP or FDA that was used in this assessment was on wheat grain. For the most part, only the parent atrazine has been monitored by FDA or PDP, and there has been sparse monitoring data for all the crops except sweet corn and wheat grain. Where monitoring data existed, no residues were detected except in wheat grain (and in isolated spinach and lettuce samples). (One sample of a cooked chicken breast was also found positive for atrazine at 0.001 ppm in the FDA Total Diet Survey. No other residues of atrazine were found in all of the Total Diet Study sampling over the years 1991 - 1999.)

Because no chloro-metabolite residues of atrazine were detected on corn or sorghum grain in monitoring or in field trials, chloro-metabolite residues in corn and sorghum grain could be more accurately estimated from the metabolism studies. Metabolism studies were more accurate because these assays provided much more sensitive estimates of atrazine chloro-metabolite residues than the monitoring or field trial testing. Even so, these estimates are conservative since the residues of chloro-metabolites are less than the total radioactive residues measured in an organic extract.

In 1997 FDA detected illegal residues of atrazine in six lettuce products from Florida: (one endive, one iceberg lettuce and four Romaine lettuce samples) ranging from a trace to 45 ppb. PDP also detected illegal residues of atrazine in 4 spinach samples from New York in 1995-1996. Neither the residues on spinach nor on lettuce are important enough to contribute significantly to dietary exposure, and these crops were not further investigated in this assessment.

Wheat samples collected by PDP also had higher residues of parent atrazine than was expected from field trials. Tolerances exist for atrazine in wheat, but the only currently labeled use for atrazine on wheat is as a treatment to wheat stubble prior to a fallow period. In addition to being higher than expected, atrazine residues were found by PDP in wheat in a somewhat larger percentage (1.7%) than the 1% of the wheat crop treated that had been estimated by BEAD. The portion of wheat samples in excess of 1% found positive may either be explained by crop rotation after use of atrazine on corn or sorghum, or by the fact that wheat is blended, or by both. Although DEEM critical commodity analyses show wheat contributing somewhat to atrazine chloro-metabolite exposure, when the dietary exposure assessment is rerun with wheat completely removed, the actual estimated exposure does not change at all for any population subgroup in either of the chronic assessments. In the acute assessment the exposure for females 13-50 only decreases from 0.000041 mg/Kg/day to 0.000040 mg/Kg/day when wheat is removed.

The major contributors to exposure to atrazine and the chloro-metabolites were meat and milk. Because the residues in these commodities was estimated using a mass balance approach, the residues in meat and milk are expected to be conservative. Exposure through meat and milk foods predominates because atrazine residues occur primarily on the stems and leaves of corn and other crops, the parts used as animal feeds. Excepting wheat, residues seem not to be found in the grains and nuts, the parts eaten by humans. Residues of atrazine also were not found and were not expected in sugarcane or in refined cane sugar.

For all population subgroups, corn was the major contributor for chronic exposure to the hydroxy-metabolites. The exact estimated dietary exposure to the hydroxy-metabolites is sensitive to uncertainties in the measurement of the hydroxy-metabolites in corn. The measurements submitted covered only two of the four expected hydroxy-metabolites and all results, but one result for one metabolite, were non detects. If the remaining two metabolites are assumed to be present at one half the same limit of detection as the measured metabolites, estimated exposure for children 1-6 rises from the reported 0.000059 mg/kg/day to 0.000116 mg/Kg/day. If everything else in the assessment is held constant, but all of the non-detects for the two measured metabolites in corn are assumed to be zero, and the two unmeasured metabolites are also assumed to be zero, the estimated exposure for children 1-6 drops to 0.000010 mg/kg/day. Note that the residues estimated on corn are conservative because ½ LOD from the field trials was used, rather than the more sensitive metabolism data. Field trial data were used because the one metabolite was seen above the LOD in one sample.

Sensitivity analyses were also performed for both assessments of atrazine and it's chloro-metabolites, and for the chronic assessment for hydroxy atrazine. This was done to estimate the uncertainty from the ND residues on crops. All ND results were set to zero in these sensitivity analyses. The results of these sensitivity analyses are attached (attachments 6.a, 6.b, and 6.c.).

While some processing data is available for the sugarcane products, no other cooking or processing information was available for atrazine, and all other processing factors are DEEM™ default factors.

List of Attachments

Attachment 1: Chronic Dietary Exposure Results
    (A) For parent and chloro-metabolites (B) For hydroxy metabolites
Attachment 2: Acute Dietary Exposure Results
Attachment 3: Chronic Dietary Exposure Assessment Files
    (A) For parent and chloro-metabolites (B) For hydroxy metabolites
Attachment 4: Acute Dietary Exposure Assessment Files
Attachment 5: RDF Files

Attachment 6: Sensitivity Analysis, Replacing Non Detects with Zeros
(A) Chronic Chloro-Metabolite Assessment (B) Acute Assessment (C) Chronic Hydroxy-Metabolite Assessment
Attachment 7: Crop Usage Estimates

cc:RRB3RF; C. Eiden; D. Soderberg; S. Knizner, D. Hrdy, W. Cutchin; 7509c:RRB3 C. Eiden:CM-2:821D:308-4137

APPENDIX A:
Data from Atrazine Animal Feeding and Metabolism Studies Used to Calculate Anticipated Residues in Meat and Milk

Atrazine and Chlorinated Metabolites

There is an adequate atrazine feeding and metabolism study for dairy cows (MRID 40431424). The tables below contain residue data from these studies after dosing at 3.75 ppm. In all matrices the only compounds detected were either atrazine, per se, or diamino chlorotriazine (DACT). In these tables DACT has been reported as atrazine molar equivalents. The molecular weight ratio for calculating DACT residues as atrazine equivalents is 216/146 = 1.48.

<u>Kidney</u>
Table A1 contains residue data from beef kidney samples at the 3.75 ppm dosing level. All samples with non-detectable residues (<0.01 ppm) were included in the calculations as ½ the LOD (0.005 ppm).

Table A1. Residues of atrazine and chloro-metabolites in beef kidney (ppm)

Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT*	combined
14	<0.01	<0.01	<0.01	0.01776	0.0328
21	<0.01	<0.01	<0.01	0.01628	0.0313
28	<0.01	<0.01	<0.01	0.02072	0.0357

* converted to atrazine equivalents.

<u>Muscle</u>
Table A2 contains residue data from beef muscle samples at the 3.75 ppm dosing level. All samples with non-detectable residues (<0.01 ppm) were included in the calculations for ARs as ½ the LOD (0.005 ppm).

Table A2. Residues of atrazine and chloro-metabolites in beef muscle (ppm)

Tissue	Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT*	combined*
Loin	14	<0.01	<0.01	<0.01	0.02516	0.0402
	21	<0.01	<0.01	<0.01	0.02368	0.0387
	28	<0.01	<0.01	<0.01	0.0296	0.0446
Round	14	<0.01	<0.01	<0.01	<0.01	0.02
	21	<0.01	<0.01	<0.01	<0.01	0.02

Tissue	Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT*	combined*
		<0.01	<0.01	<0.01	<0.01	0.02

* converted to atrazine equivalents.

<u>Fat</u>
Table A3 contains residue data from beef fat samples at the 3.75 ppm dosing level. All samples had non-detectable residues (<0.01 ppm) and were included in the calculations for ARs as ½ the LOD (0.005 ppm).

Table A3. Residues of atrazine and chloro-metabolites in beef fat (ppm)

Tissue	Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT	Combined
Omental	14	<0.01	<0.01	<0.01	<0.01	0.02
	21	<0.01	<0.01	<0.01	<0.01	0.02
	28	<0.01	<0.01	<0.01	<0.01	0.02
Perirenal	14	<0.01	<0.01	<0.01	<0.01	0.02
	21	<0.01	<0.01	<0.01	<0.01	0.02
	28	<0.01	<0.01	<0.01	<0.01	0.02

<u>Liver</u>
Table A4 contains residue data from beef liver samples at the 3.75 ppm dosing level. All samples had non-detectable residues (<0.01 ppm) and were included in the calculations for ARs as ½ the LOD (0.005 ppm). Once combined, residues were adjusted (extrapolated) to the TDB* (1X) feeding level for beef cows.

Table A4. Residues of atrazine and chlor-metabolites in beef liver(ppm)

Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT	Combined
14	<0.01	<0.01	<0.01	<0.01	0.02
21	<0.01	<0.01	<0.01	<0.01	0.02
28	<0.01	<0.01	<0.01	<0.01	0.02
14	<0.01	<0.01	<0.01	<0.01	0.02
21	<0.01	<0.01	<0.01	<0.01	0.02
28	<0.01	<0.01	<0.01	<0.01	0.02

<u>Milk</u>
Table A5 contains residue data from cow's milk samples at the 3.75 ppm dosing level. All samples with non-detectable residues (<0.01 ppm)were included in the calculations for ARs as ½ the LOD (0.005 ppm). Only atrazine and DACT were found in measurable quantities in these samples. Other chlorometabolites were not detected. Residues of DACT are expressed in atrazine equivalents. The average combined residues were used to estimate residues for chronic exposure: 0.0446 ppm residue in milk/3.75 ppm atrazine dosed. For estimating

residues for acute exposure, the residues on day one were discarded. Average residues for each day were then calculated for day 2, 7, 12, 19, and 26. These average residues/day were then averaged to yield 0.0409 ppm residue in milk/3.75 ppm atrazine dosed.

Table A5. Residues of atrazine and chloro-metabolites in cow's milk (ppm) *

Dose day	atrazine	desethyl atrazine	des-isopropyl atrazine	DACT	combined
1	<0.01	<0.01	<0.01	0.0296	0.0446
1	<0.01	<0.01	<0.01	0.0296	0.0446
1	<0.01	<0.01	<0.01	0.0296	0.0446
2	0.04	<0.01	<0.01	0.0444	0.0944
2	<0.01	<0.01	<0.01	0.0296	0.0446
2	<0.01	<0.01	<0.01	0.0148	0.0298
7	<0.01	<0.01	<0.01	0.0296	0.0446
7	<0.01	<0.01	<0.01	0.0444	0.0594
7	<0.01	<0.01	<0.01	0.0148	0.0298
12	<0.01	<0.01	<0.01	0.0296	0.0446
12	<0.01	<0.01	<0.01	0.0444	0.0594
12	<0.01	<0.01	<0.01	0.0444	0.0594
19	<0.01	<0.01	<0.01	<0.01	0.02
19	<0.01	<0.01	<0.01	<0.01	0.02
26	<0.01	<0.01	<0.01	0.0148	0.0298

* Quantifiable residues converted to atrazine equivalents.

Hydroxy Metabolites

Table A6 contains residue data used to estimate concentrations of hydroxy metabolites of atrazine in meat and milk from goats. These data were used to calculate ARs for use in chronic dietary assessment for hydroxy atrazine metabolites. These data are from MRID 42925601.

Table A6. Residues (ppm) of atrazine hydroxy metabolites in goat tissues and milk after dosing at 113 ppm

Matrix	TRR	Hydroxyatrazine	Desisopropyl hydroxy atrazine	Desethyl hydroxy atrazine	Combined hydroxy metabolites
Milk	0.56	0.26	0.05	0.026	0.336
Liver	1.18	0.238	0.039	0.039	0.316
Kidney	2.57	1.23	0.077	0.216	1.523
Tenderloin	0.21	0.115	0.029	0.008	0.152
Perirenal fat	0.16	0.079	0.019	0.005	0.103

APPENDIX B.
Tables of Residue Data Corn Forage from Field Trials

Corn Forage

Tables B1, B2, and B3 provide residues of atrazine and the chloro-metabolites converted to atrazine equivalents in ppm.. These data were used to estimate average residues of atrazine and the chloro-metabolites in corn forage for use in estimating theoretical dietary burdens on which to base anticipated residues in animal tissues and milk for the chronic dietary assessments. Tables B1, B2 and B3 contain residue data from field trials conducted at each of the 3 use scenarios previously described for atrazine use on corn. All scenarios are for 30 day PHI except for the pre-emergence 2.0 lbs ai/A, for which only 60 day PHI information was available.

Table B4 provides residues of atrazine and the chloro-metabolites of atrazine in the 0.5 lbs ai/A pre- and 2.0 lbs ai/A postemergence scenario at 60 day PHI. These data contained the highest average field trial (HAFT) which was used to estimate theoretical dietary burdens on which to base residues in meat and milk for the acute dietary exposure assessment.

These data can be found in MRIDs 44597602, 44315410, and 44152117.

Table B1.

ATRAZINE ANTICIPATED RESIDUES

Residue data for use in risk assessment- atrazine and chloro-metabolites; **field corn forage**; 90% DF; 1.5 lb ai/A pre +1.0 lb ai/A postemergence, 30 day PHI

	Residues (ppm) [a, b]				
Location	Atrazine	G-30033	G-28279	G-28273	Combined
Champaign Co. IL	0.0070	0.0025	0.0074	0.0025	0.0194
Champaign Co. IL	0.0150	0.0025	0.0025	0.0025	0.0225
Champaign Co. IL	0.0070	0.0069	0.0025	0.0133	0.0297
Champaign Co. IL	0.0070	0.0025	0.0025	0.0089	0.0209
Hamilton Co, IN	0.0100	0.0025	0.0025	0.0025	0.0175
Hamilton Co, IN	0.0210	0.0025	0.0025	0.0025	0.0285
Hamilton Co, IN	0.0060	0.0025	0.0025	0.0025	0.0135
Hamilton Co, IN	0.0080	0.0025	0.0025	0.0025	0.0155
Grundy Co. IA	0.0025	0.0025	0.0025	0.0074	0.0149
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0120	0.0025	0.0025	0.0178	0.0348
Grundy Co. IA	0.0025	0.0069	0.0025	0.0118	0.0237
Grundy Co. IA	0.1340	0.0104	0.0211	0.0385	0.2039
Grundy Co. IA	0.0790	0.0092	0.0174	0.0474	0.1529
Grundy Co. IA	0.0190	0.0196	0.0025	0.0133	0.0544
Grundy Co. IA	0.0170	0.0207	0.0025	0.0148	0.0550
Fayette Co. KY	0.0025	0.0025	0.0025	0.0025	0.0100
Fayette Co. KY	0.0025	0.0025	0.0025	0.0163	0.0238
Fayette Co. KY	0.0025	0.0025	0.0025	0.0025	0.0100
Fayette Co. KY	0.0025	0.0025	0.0025	0.0025	0.0100
Ingham Co. MI	0.0090	0.0025	0.0025	0.0163	0.0303
Ingham Co. MI	0.0025	0.0025	0.0025	0.0207	0.0282
Ingham Co. MI	0.0025	0.0115	0.0025	0.0148	0.0313
Ingham Co. MI	0.0025	0.0138	0.0025	0.0207	0.0395
Wilkin Co. MN	0.0130	0.0025	0.0025	0.0025	0.0205
Wilkin Co. MN	0.0025	0.0025	0.0025	0.0025	0.0100
Wilkin Co. MN	0.1800	0.0025	0.0025	0.0133	0.1983
Wilkin Co. MN	0.2370	0.0025	0.0025	0.0104	0.2524
Shelby Co. MO	0.0300	0.0081	0.0025	0.0025	0.0431
Shelby Co. MO	0.0190	0.0092	0.0062	0.0118	0.0462
	0.0286			**Average 30-day PHI**	**0.0490**

a. Individual values are corrected for molecular weight, except those at 1/2LOD, or 0.0025 ppm.

b. The "combined" column is the sum of the previous 4 columns.

Table B2

ATRAZINE ANTICIPATED RESIDUES

Residue data for use in risk assessment- atrazine and chloro-metabolites;
field corn forage; 90% DF; 2.0 lb ai/A preemergence, 60 day PHI

	Residues (ppm) [a, b]				
Location	Atrazine	G-30033	G-28279	G-28273	Combined
Champaign Co. IL	0.0110	0.0025	0.0025	0.0025	0.0185
Champaign Co. IL	0.0100	0.0025	0.0025	0.0025	0.0175
Hamilton Co, IN	0.0025	0.0025	0.0025	0.0025	0.0100
Hamilton Co, IN	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0124	0.0025	0.0199
Grundy Co. IA	0.0060	0.0025	0.0025	0.0025	0.0135
Grundy Co. IA	0.0070	0.0025	0.0025	0.0025	0.0145
Fayette Co. KY	0.0060	0.0025	0.0025	0.0025	0.0135
Fayette Co. KY	0.0060	0.0025	0.0025	0.0025	0.0135
Ingham Co. MI	0.0025	0.0069	0.0112	0.0178	0.0383
Ingham Co. MI	0.0025	0.0025	0.0070	0.0192	0.0312
Ingham Co. MI	0.0025	0.0025	0.0025	0.0025	0.0100
Ingham Co. MI	0.0060	0.0025	0.0025	0.0025	0.0135
Wilkin Co. MN	0.0400	0.0104	0.0149	0.0192	0.0845
Wilkin Co. MN	0.0310	0.0080	0.0223	0.0133	0.0746
Shelby Co. MO	0.0090	0.0150	0.0074	0.0133	0.0447
Shelby Co. MO	0.0080	0.0150	0.0112	0.0178	0.0519
York Co. NE	0.0170	0.0069	0.0074	0.0148	0.0461
York Co. NE	0.0190	0.0081	0.0087	0.0163	0.0520
Columbia Co. NY	0.0130	0.0069	0.0025	0.0025	0.0249
Columbia Co. NY	0.0100	0.0025	0.0025	0.0025	0.0175
Wayne Co, NC	0.0025	0.0025	0.0099	0.0178	0.0327
Wayne Co, NC	0.0025	0.0025	0.0025	0.0207	0.0282
Wayne Co, NC	0.0025	0.0025	0.0062	0.0340	0.0452
Wayne Co, NC	0.0025	0.0069	0.0087	0.0281	0.0462
Fayette Co. OH	0.0025	0.0025	0.0025	0.0326	0.0401
Fayette Co. OH	0.0025	0.0025	0.0025	0.0266	0.0341
Yankton Co. SD	0.0060	0.0025	0.0025	0.0025	0.0135
Yankton Co. SD	0.0025	0.0025	0.0025	0.0025	0.0100
Burleson Co. TX	0.0025	0.0025	0.0025	0.0025	0.0100
Burleson Co. TX	0.0025	0.0025	0.0025	0.0025	0.0100
Burleson Co. TX	0.0025	0.0025	0.0025	0.0025	0.0100
Burleson Co. TX	0.0250	0.0025	0.0025	0.0025	0.0325
Walworth Co., WI	0.0025	0.0025	0.0025	0.0074	0.0149
Walworth Co., WI	0.0070	0.0069	0.0087	0.0163	0.0389
	0.0076			**Average**	**0.0268**

a. Individual values are corrected for molecular weight, except those at 1/2LOD, or 0.0025 ppm.

b. The "combined" column is the sum of the previous 4 columns.

Table B3.

ATRAZINE ANTICIPATED RESIDUES

Residue data for use in risk assessment- atrazine and chloro-metabolites;
field corn forage; 90% DF; 0.5 lb ai/A pre +2.0 lb ai/A postemergence - **30 day PHI**

	Residues (ppm) [a, b]				
Location	Atrazine	G-30033	G-28279	G-28273	Combined
Champaign Co. IL	0.0260	0.0025	0.0025	0.0025	0.0335
Champaign Co. IL	0.0150	0.0025	0.0025	0.0025	0.0225
Champaign Co. IL	0.0150	0.0025	0.0025	0.0025	0.0225
Hamilton Co, IN	0.0190	0.0863	0.0025	0.0089	0.1166
Hamilton Co, IN	0.0330	0.0115	0.0025	0.0104	0.0574
Grundy Co. IA	0.0080	0.0025	0.0025	0.0148	0.0278
Grundy Co. IA	0.0025	0.0025	0.0025	0.0104	0.0179
Grundy Co. IA	0.0060	0.0025	0.0025	0.0025	0.0135
Grundy Co. IA	0.0350	0.0025	0.0025	0.0025	0.0425
Grundy Co. IA	0.0670	0.0025	0.0025	0.0025	0.0745
Fayette Co. KY	0.0025	0.0025	0.0025	0.0025	0.0100
Fayette Co. KY	0.0025	0.0025	0.0025	0.0025	0.0100
Ingham Co. MI	0.0060	0.0025	0.0025	0.0178	0.0288
Ingham Co. MI	0.0025	0.0069	0.0025	0.0163	0.0282
Wilkin Co. MN	0.1050	0.0081	0.0161	0.0222	0.1514
Wilkin Co. MN	0.1620	0.0092	0.0198	0.0148	0.2058
Shelby Co. MO	0.0250	0.0253	0.0025	0.0148	0.0676
Shelby Co. MO	0.0100	0.0115	0.0124	0.0178	0.0517
York Co. NE	0.0025	0.0025	0.0025	0.0118	0.0193
York Co. NE	0.0130	0.0092	0.0025	0.0503	0.0750
Columbia Co. NY	0.0110	0.0025	0.0025	0.0025	0.0185
Columbia Co. NY	0.0025	0.0025	0.0025	0.0025	0.0100
Wayne Co, NC	0.0960	0.0025	0.0025	0.0725	0.1735
Wayne Co, NC	0.0240	0.0025	0.0074	0.0681	0.1020
Fayette Co. OH	0.0450	0.0081	0.0025	0.0133	0.0689
Fayette Co. OH	0.0110	0.0081	0.0025	0.0104	0.0319
Yankton Co. SD	0.0200	0.0025	0.0025	0.0025	0.0275
Yankton Co. SD	0.1380	0.0025	0.0025	0.0025	0.1455
Burleson Co. TX	0.3810	0.0025	0.0025	0.0281	0.4141
Burleson Co. TX	0.5280	0.0025	0.0025	0.0222	0.5552
Walworth Co., WI	0.0270	0.0025	0.0074	0.0148	0.0517
Walworth Co., WI				0.0163	0.0163
	0.0575		**Average 30-day PHI**		**0.0841**

a. Individual values are corrected for molecular weight, except those at 1/2LOD,

or 0.0025 ppm.
b. The "combined" column is the sum of the previous 4 columns.

Table B4

ATRAZINE ANTICIPATED RESIDUES

Residue data for use in risk assessment- atrazine and chloro-metabolites;
field corn forage; 90% DF; 0.5 lb ai/A pre +2.0 lb ai/A postemergence - **60 day PHI**

Residues (ppm) [a, b]					
Location	Atrazine	G-30033	G-28279	G-28273	Combined
Champaign Co. IL	0.0025	0.0025	0.0025	0.0025	0.0100
Champaign Co. IL	0.0025	0.0025	0.0025	0.0025	0.0100
Champaign Co. IL	0.0430	0.0265	0.0223	0.0266	0.1184
Hamilton Co, IN	0.0025	0.0025	0.0025	0.0148	0.0223
Hamilton Co, IN	0.0210	0.0025	0.0025	0.0133	0.0393
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0025	0.0025	0.0025	0.0025	0.0100
Grundy Co. IA	0.0740	0.0025	0.0025	0.0089	0.0879
Grundy Co. IA	0.0180	0.0025	0.0025	0.0118	0.0348
Fayette Co. KY	0.0025	0.0025	0.0025	0.0118	0.0193
Fayette Co. KY	0.0025	0.0025	0.0025	0.0118	0.0193
Ingham Co. MI	0.0025	0.0025	0.0025	0.0192	0.0267
Ingham Co. MI	0.0025	0.0025	0.0025	0.0118	0.0193
Wilkin Co. MN	0.0110	0.0025	0.0025	0.0025	0.0185
Wilkin Co. MN	0.0120	0.0025	0.0025	0.0148	0.0318
Shelby Co. MO	0.0025	0.0025	0.0025	0.0118	0.0193
Shelby Co. MO	0.0025	0.0025	0.0025	0.0133	0.0208
York Co. NE	0.0025	0.0025	0.0025	0.0148	0.0223
York Co. NE	0.0025	0.0025	0.0025	0.0296	0.0371
Columbia Co. NY	0.0025	0.0025	0.0025	0.0025	0.0100
Columbia Co. NY	0.0025	0.0025	0.0025	0.0025	0.0100
Wayne Co, NC	0.0025	0.0025	0.0025	0.0326	0.0401
Wayne Co, NC	0.0060	0.0025	0.0025	0.0252	0.0362
Fayette Co. OH	0.0025	0.0025	0.0025	0.0281	0.0356
Fayette Co. OH	0.0025	0.0025	0.0025	0.0207	0.0282
Yankton Co. SD	0.0025	0.0025	0.0025	0.0518	0.0593
Yankton Co. SD	0.0025	0.0025	0.0031	0.0355	0.0436
Burleson Co. TX	1.0600	0.0150	0.0074	0.0222	1.1046
Burleson Co. TX	0.1910	0.0025	0.0025	0.0192	0.2152
Walworth Co., WI	0.0360	0.0025	0.0025	0.0163	0.0573
Walworth Co., WI	0.0070	0.0025	0.0025	0.0178	0.0298
	0.0479		**Average 60-day PHI**		**0.0705**

a. Individual values are corrected for molecular weight, except those at 1/2LOD, or 0.0025 ppm.
b. The "combined" column is the sum of the previous 4 columns.

Attachment 1 (A) Chronic Assessment for Chloro-metabolites

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U.S. Environmental Protection Agency                                Ver. 7.075
DEEM Chronic analysis for ATRAZINE                               (1989-92 data)
Residue file name: D:\atz_deem_chronic2b.RS7     Adjustment factor #2 NOT used.
Analysis Date 01-04-2001/15:25:11     Residue file dated: 01-04-2001/15:21:51/8
Reference dose (RfD, Chronic) = .0018 mg/kg bw/day
COMMENT 1: chronic assessment for atrazine and chloro-metabolites
===============================================================================
                    Total exposure by population subgroup
-------------------------------------------------------------------------------
```

Population Subgroup	Total Exposure: mg/kg body wt/day	Total Exposure: Percent of Rfd
U.S. Population (total)	0.000005	0.3%
U.S. Population (spring season)	0.000005	0.3%
U.S. Population (summer season)	0.000005	0.3%
U.S. Population (autumn season)	0.000005	0.3%
U.S. Population (winter season)	0.000005	0.3%
Northeast region	0.000005	0.3%
Midwest region	0.000006	0.3%
Southern region	0.000005	0.3%
Western region	0.000005	0.3%
Hispanics	0.000005	0.3%
Non-hispanic whites	0.000005	0.3%
Non-hispanic blacks	0.000005	0.3%
Non-hisp/non-white/non-black	0.000005	0.3%
All infants (< 1 year)	0.000008	0.5%
Nursing infants	0.000002	0.1%
Non-nursing infants	0.000011	0.6%
Children 1-6 yrs	0.000017	0.9%
Children 7-12 yrs	0.000009	0.5%
Females 13-19 (not preg or nursing)	0.000004	0.2%
Females 20+ (not preg or nursing)	0.000003	0.1%
Females 13-50 yrs	0.000003	0.2%
Females 13+ (preg/not nursing)	0.000005	0.3%
Females 13+ (nursing)	0.000004	0.2%
Males 13-19 yrs	0.000006	0.3%
Males 20+ yrs	0.000003	0.2%
Seniors 55+	0.000003	0.1%
Pacific Region	0.000005	0.3%

Attachment 1 (B) Chronic Assessment for Hydroxy-metabolites

```
U.S. Environmental Protection Agency                                 Ver. 7.075
DEEM Chronic analysis for ATRAZINE                                 (1989-92 data)
Residue file name: D:\atrazinehydoxy5b.RS7       Adjustment factor #2 NOT used.
Analysis Date 01-05-2001/13:14:31     Residue file dated: 01-05-2001/13:12:56/8
Reference dose (RfD, Chronic) = .01 mg/kg bw/day
COMMENT 1: parent & hydroxy metabolites
===============================================================================
                    Total exposure by population subgroup
-------------------------------------------------------------------------------
```

Population Subgroup	Total Exposure mg/kg body wt/day	Total Exposure Percent of Rfd
U.S. Population (total)	0.000025	0.3%
U.S. Population (spring season)	0.000025	0.3%
U.S. Population (summer season)	0.000026	0.3%
U.S. Population (autumn season)	0.000026	0.3%
U.S. Population (winter season)	0.000024	0.2%
Northeast region	0.000023	0.2%
Midwest region	0.000027	0.3%
Southern region	0.000026	0.3%
Western region	0.000024	0.2%
Hispanics	0.000026	0.3%
Non-hispanic whites	0.000025	0.2%
Non-hispanic blacks	0.000029	0.3%
Non-hisp/non-white/non-black	0.000023	0.2%
All infants (< 1 year)	0.000056	0.6%
Nursing infants	0.000014	0.1%
Non-nursing infants	0.000074	0.7%
Children 1-6 yrs	0.000059	0.6%
Children 7-12 yrs	0.000045	0.5%
Females 13-19 (not preg or nursing)	0.000025	0.3%
Females 20+ (not preg or nursing)	0.000016	0.2%
Females 13-50 yrs	0.000019	0.2%
Females 13+ (preg/not nursing)	0.000018	0.2%
Females 13+ (nursing)	0.000020	0.2%
Males 13-19 yrs	0.000032	0.3%
Males 20+ yrs	0.000018	0.2%
Seniors 55+	0.000014	0.1%
Pacific Region	0.000022	0.2%

Attachment 2. Acute Assessment for Chloro-metabolites

```
U.S. Environmental Protection Agency                    Ver. 7.075
DEEM ACUTE analysis for ATRAZINE                        (1989-92 data)
Residue file: atz_deem_acute4b.RS7            Adjustment factor #2 NOT used.
Analysis Date: 01-11-2001/11:26:31    Residue file dated: 01-04-2001/15:18:54/8
NOEL (Acute) =  10.000000 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
MC iterations = 1000      MC list in residue file     MC seed = 10
Run Comment: "acute assessment for atrazine and chloro-metabolites"
===============================================================================

Summary calculations (per capita):

     95th Percentile           99th Percentile           99.9th Percentile
 Exposure  % aRfD     MOE    Exposure  % aRfD     MOE    Exposure  % aRfD     MOE
---------- ------- -------- ---------- ------- -------- ---------- ------- --------
U.S. Population:
  0.000027    0.27  367037    0.000048    0.48  210036    0.000076    0.76  131457
Females 13-50 yrs:
  0.000017    0.17  602939    0.000025    0.25  395004    0.000041    0.41  242366
```

Attachment 3 (A) Chronic Dietary Exposure Assessment Files for Chloro-metabolites

```
U.S. Environmental Protection Agency                              Ver. 7.075
DEEM Chronic analysis for ATRAZINE                               1989-92 data
Residue file: D:\atz_deem_chronic2b.RS7                    Adjust. #2 NOT used
Analysis Date 01-10-2001             Residue file dated: 01-04-2001/15:21:51/8
Reference dose (RfD) = 0.0018 mg/kg bw/day
Comment:chronic assessment for atrazine and chloro-metabolites
--------------------------------------------------------------------------------
Food Crop                                  RESIDUE         Adj.Factors
Code  Grp  Food Name                        (ppm)           #1     #2
---- ---- ------------------------------  ----------      ------ ------
  46 14   Macadamia nuts (bush nuts)        0.057000       1.000  1.000
  79 O    Guava                             0.005000       1.000  1.000
 237 15   Corn/pop
             12-Cooked: NFS                 0.000210       1.000  1.000
             13-Baked                       0.000210       1.000  1.000
 238 15   Corn/sweet
             11-Uncooked                    0.000140       1.000  1.000
             12-Cooked: NFS                 0.000140       1.000  1.000
             13-Baked                       0.000140       1.000  1.000
             14-Boiled                      0.000140       1.000  1.000
             32-Canned: Cooked              0.000160       1.000  1.000
             34-Canned: Boiled              0.000160       1.000  1.000
             35-Canned: Fried               0.000160       1.000  1.000
             42-Frozen: Cooked              0.000160       1.000  1.000
 266 15   Corn grain-endosperm
             11-Uncooked                    0.000210       1.000  1.000
             12-Cooked: NFS                 0.000210       1.000  1.000
             13-Baked                       0.000210       1.000  1.000
             14-Boiled                      0.000210       1.000  1.000
             15-Fried                       0.000210       1.000  1.000
             31-Canned: NFS                 0.000210       1.000  1.000
             32-Canned: Cooked              0.000210       1.000  1.000
             33-Canned: Baked               0.000210       1.000  1.000
             34-Canned: Boiled              0.000210       1.000  1.000
             41-Frozen: NFS                 0.000210       1.000  1.000
             42-Frozen: Cooked              0.000210       1.000  1.000
             43-Frozen: Baked               0.000210       1.000  1.000
             45-Frozen: Fried               0.000210       1.000  1.000
             99-Alcohol/Fermented/Distilled 0.000210       1.000  1.000
 267 15   Corn grain-bran
             12-Cooked: NFS                 0.000210       1.000  1.000
             13-Baked                       0.000210       1.000  1.000
             14-Boiled                      0.000210       1.000  1.000
             15-Fried                       0.000210       1.000  1.000
             31-Canned: NFS                 0.000210       1.000  1.000
 268 15   Corn grain/sugar/hfcs
             98-Refined                     0.000210       1.500  1.000
 275 15   Sorghum (including milo)          0.000550       1.000  1.000
 276 15   Wheat-rough                       0.000310       1.000  1.000
 277 15   Wheat-germ                        0.000310       1.000  1.000
 278 15   Wheat-bran                        0.000310       1.000  1.000
 279 15   Wheat-flour                       0.000310       1.000  1.000
 283 O    Sugar-cane                        0.001500       1.000  1.000
```

284	O	Sugar-cane/molasses	0.076000	1.000	1.000
289	15	Corn grain-oil			
		98-Refined	0.000210	1.000	1.000
318	D	Milk-nonfat solids	0.000500	1.000	1.000
319	D	Milk-fat solids	0.000500	1.000	1.000
320	D	Milk sugar (lactose)	0.000500	1.000	1.000
321	M	Beef-meat byproducts	0.000200	1.000	1.000
322	M	Beef-other organ meats	0.000300	1.000	1.000
323	M	Beef-dried	0.000300	1.920	1.000
324	M	Beef-fat w/o bones	0.000200	1.000	1.000
325	M	Beef-kidney	0.000300	1.000	1.000
326	M	Beef-liver	0.000200	1.000	1.000
327	M	Beef-lean (fat/free) w/o bones	0.000300	1.000	1.000
328	M	Goat-meat byproducts	0.000300	1.000	1.000
329	M	Goat-other organ meats	0.000300	1.000	1.000
330	M	Goat-fat w/o bone	0.000200	1.000	1.000
331	M	Goat-kidney	0.000300	1.000	1.000
332	M	Goat-liver	0.000200	1.000	1.000
333	M	Goat-lean (fat/free) w/o bone	0.000300	1.000	1.000
334	M	Horsemeat	0.000300	1.000	1.000
336	M	Sheep-meat byproducts	0.000300	1.000	1.000
337	M	Sheep-other organ meats	0.000300	1.000	1.000
338	M	Sheep-fat w/o bone	0.000200	1.000	1.000
339	M	Sheep-kidney	0.000300	1.000	1.000
340	M	Sheep-liver	0.000200	1.000	1.000
341	M	Sheep-lean (fat free) w/o bone	0.000300	1.000	1.000
388	15	Corn grain/sugar-molasses			
		12-Cooked: NFS	0.000210	1.500	1.000
		41-Frozen: NFS	0.000210	1.500	1.000
393	O	Guava-juice	0.005000	1.000	1.000
398	D	Milk-based water	0.000500	1.000	1.000
424	M	Veal-fat w/o bones	0.000200	1.000	1.000
425	M	Veal-lean (fat free) w/o bones	0.000300	1.000	1.000
426	M	Veal-kidney	0.000300	1.000	1.000
427	M	Veal-liver	0.000200	1.000	1.000
428	M	Veal-other organ meats	0.000300	1.000	1.000
429	M	Veal-dried	0.000300	1.920	1.000
430	M	Veal-meat byproducts	0.000300	1.000	1.000
437	15	Wheat-germ oil	0.000310	1.000	1.000

Attachment 3 (B) Chronic Dietary Exposure Assessment Files for Hydroxy-metabolites

```
U.S. Environmental Protection Agency                                Ver. 7.075
DEEM Chronic analysis for ATRAZINE                                1989-92 data
Residue file: D:\atrazinehydoxy5b.RS7                       Adjust. #2 NOT used
Analysis Date 01-10-2001            Residue file dated: 01-10-2001/10:50:05/8
Reference dose (RfD) = 0.01 mg/kg bw/day
Comment:parent & hydroxy metabolites
-------------------------------------------------------------------------------
Food Crop                                     RESIDUE        Adj.Factors
Code  Grp  Food Name                           (ppm)          #1     #2
---- ---- ------------------------------  ----------       ------ ------
  46 14   Macadamia nuts (bush nuts)        0.142500       1.000  1.000
  79 O    Guava                             0.005000       1.000  1.000
 237 15   Corn/pop
             12-Cooked: NFS                 0.017000       1.000  1.000
             13-Baked                       0.017000       1.000  1.000
 238 15   Corn/sweet
             11-Uncooked                    0.011000       1.000  1.000
             12-Cooked: NFS                 0.011000       1.000  1.000
             13-Baked                       0.011000       1.000  1.000
             14-Boiled                      0.011000       1.000  1.000
             32-Canned: Cooked              0.013000       1.000  1.000
             34-Canned: Boiled              0.013000       1.000  1.000
             35-Canned: Fried               0.013000       1.000  1.000
             42-Frozen: Cooked              0.013000       1.000  1.000
 266 15   Corn grain-endosperm
             11-Uncooked                    0.017000       1.000  1.000
             12-Cooked: NFS                 0.017000       1.000  1.000
             13-Baked                       0.017000       1.000  1.000
             14-Boiled                      0.017000       1.000  1.000
             15-Fried                       0.017000       1.000  1.000
             31-Canned: NFS                 0.017000       1.000  1.000
             32-Canned: Cooked              0.017000       1.000  1.000
             33-Canned: Baked               0.017000       1.000  1.000
             34-Canned: Boiled              0.017000       1.000  1.000
             41-Frozen: NFS                 0.017000       1.000  1.000
             42-Frozen: Cooked              0.017000       1.000  1.000
             43-Frozen: Baked               0.017000       1.000  1.000
             45-Frozen: Fried               0.017000       1.000  1.000
             99-Alcohol/Fermented/Distilled 0.017000       1.000  1.000
 267 15   Corn grain-bran
             12-Cooked: NFS                 0.017000       1.000  1.000
             13-Baked                       0.017000       1.000  1.000
             14-Boiled                      0.017000       1.000  1.000
             15-Fried                       0.017000       1.000  1.000
             31-Canned: NFS                 0.017000       1.000  1.000
 268 15   Corn grain/sugar/hfcs             0.017000       1.500  1.000
 275 15   Sorghum (including milo)          0.001475       1.000  1.000
 276 15   Wheat-rough                       0.000088       1.000  1.000
 277 15   Wheat-germ                        0.000088       1.000  1.000
 278 15   Wheat-bran                        0.000088       1.000  1.000
 279 15   Wheat-flour                       0.000088       1.000  1.000
 283 O    Sugar-cane                        0.004000       1.000  1.000
 284 O    Sugar-cane/molasses               0.023000       1.000  1.000
```

289	15	Corn grain-oil	0.017000	1.000	1.000
388	15	Corn grain/sugar-molasses	0.017000	1.500	1.000
393	O	Guava-juice	0.005000	1.000	1.000
437	15	Wheat-germ oil	0.000088	1.000	1.000

Attachment 4. Acute Dietary Exposure Assessment Files for the Chloro-metabolites

```
U.S. Environmental Protection Agency                                Ver. 7.075
DEEM Acute analysis for ATRAZINE
Residue file name: D:\atz_deem_acute4b.RS7
Analysis Date 01-10-2001             Residue file dated: 01-04-2001/15:18:54/8
Reference dose: aRfD = 0.01 mg/kg bw/day  NOEL = 10 mg/kg bw/day
Comment: acute assessment for atrazine and chloro-metabolites
-------------------------------------------------------------------------------
RDL indices and parameters for Monte Carlo Analysis:
Index Dist Parameter #1           Param #2    Param #3    Comment
  #   Code
----- ---- ------------           ----------- ----------- ----------
  1    6   atz_guava.rdf
  2    6   atz_macad.rdf
  3    6   Atz_beef.rdf
  4    6   atz_milk.rdf
  5    6   atz-beefkidney.rdf
  6    6   atz-frshswcorn.rdf
  7    6   atz-procswcorn.rdf
  8    6   atzbeeflivfat.rdf
  9    6   atzwheatpdp2.rdf

Food Crop Food Name                         Def Res     Adj.Factors  RDL
Code  Grp                                   (ppm)       #1     #2    Ind
---- ---- ------------------------------  ----------  ------ ------ ---
  46 14   Macadamia nuts (bush nuts)        0.100000   1.000  1.000   2
  79 O    Guava                             0.005000   1.000  1.000   1
 237 15   Corn/pop
             12-Cooked: NFS                 0.000240   1.000  1.000
             13-Baked                       0.000240   1.000  1.000
 238 15   Corn/sweet
             11-Uncooked                    0.000170   1.000  1.000   6
             12-Cooked: NFS                 0.000170   1.000  1.000   6
             13-Baked                       0.000170   1.000  1.000   6
             14-Boiled                      0.000170   1.000  1.000   6
             32-Canned: Cooked              0.000180   1.000  1.000   7
             34-Canned: Boiled              0.000180   1.000  1.000   7
             35-Canned: Fried               0.000180   1.000  1.000   7
             42-Frozen: Cooked              0.000180   1.000  1.000   7
 266 15   Corn grain-endosperm
             11-Uncooked                    0.000240   1.000  1.000
             12-Cooked: NFS                 0.000240   1.000  1.000
             13-Baked                       0.000240   1.000  1.000
             14-Boiled                      0.000240   1.000  1.000
             15-Fried                       0.000240   1.000  1.000
             31-Canned: NFS                 0.000240   1.000  1.000
             32-Canned: Cooked              0.000240   1.000  1.000
             33-Canned: Baked               0.000240   1.000  1.000
             34-Canned: Boiled              0.000240   1.000  1.000
             41-Frozen: NFS                 0.000240   1.000  1.000
             42-Frozen: Cooked              0.000240   1.000  1.000
             43-Frozen: Baked               0.000240   1.000  1.000
             45-Frozen: Fried               0.000240   1.000  1.000
```

		99-Alcohol/Fermented/Di	0.000240	1.000	1.000	
267	15	Corn grain-bran				
		12-Cooked: NFS	0.000240	1.000	1.000	
		13-Baked	0.000240	1.000	1.000	
		14-Boiled	0.000240	1.000	1.000	
		15-Fried	0.000240	1.000	1.000	
		31-Canned: NFS	0.000240	1.000	1.000	
268	15	Corn grain/sugar/hfcs				
		98-Refined	0.000240	1.500	1.000	
275	15	Sorghum (including milo)	0.000690	1.000	1.000	
276	15	Wheat-rough	0.000310	1.000	1.000	9
277	15	Wheat-germ	0.000310	1.000	1.000	
278	15	Wheat-bran	0.000310	1.000	1.000	
279	15	Wheat-flour	0.000310	1.000	1.000	
283	O	Sugar-cane	0.001900	1.000	1.000	
284	O	Sugar-cane/molasses	0.095000	1.000	1.000	
289	15	Corn grain-oil				
		98-Refined	0.000240	1.000	1.000	
318	D	Milk-nonfat solids	0.000600	1.000	1.000	4
319	D	Milk-fat solids	0.000600	1.000	1.000	4
320	D	Milk sugar (lactose)	0.000600	1.000	1.000	4
321	M	Beef-meat byproducts	0.000400	1.000	1.000	5
322	M	Beef-other organ meats	1.000000	1.000	1.000	8
323	M	Beef-dried	0.000250	1.920	1.000	3
324	M	Beef-fat w/o bones	1.000000	1.000	1.000	8
325	M	Beef-kidney	0.000400	1.000	1.000	5
326	M	Beef-liver	1.000000	1.000	1.000	8
327	M	Beef-lean (fat/free) w/o bones	0.000250	1.000	1.000	3
328	M	Goat-meat byproducts	0.000400	1.000	1.000	5
329	M	Goat-other organ meats	1.000000	1.000	1.000	8
330	M	Goat-fat w/o bone	1.000000	1.000	1.000	8
331	M	Goat-kidney	0.000400	1.000	1.000	5
332	M	Goat-liver	1.000000	1.000	1.000	8
333	M	Goat-lean (fat/free) w/o bone	0.000250	1.000	1.000	3
334	M	Horsemeat	0.000250	1.000	1.000	3
336	M	Sheep-meat byproducts	0.000400	1.000	1.000	5
337	M	Sheep-other organ meats	1.000000	1.000	1.000	8
338	M	Sheep-fat w/o bone	1.000000	1.000	1.000	8
339	M	Sheep-kidney	0.000400	1.000	1.000	5
340	M	Sheep-liver	1.000000	1.000	1.000	8
341	M	Sheep-lean (fat free) w/o bone	0.000250	1.000	1.000	3
388	15	Corn grain/sugar-molasses				
		12-Cooked: NFS	0.000240	1.500	1.000	
		41-Frozen: NFS	0.000240	1.500	1.000	
393	O	Guava-juice	0.005000	1.000	1.000	1
398	D	Milk-based water	0.000600	1.000	1.000	4
424	M	Veal-fat w/o bones	1.000000	1.000	1.000	8
425	M	Veal-lean (fat free) w/o bones	0.000250	1.000	1.000	3
426	M	Veal-kidney	0.000400	1.000	1.000	5
427	M	Veal-liver	1.000000	1.000	1.000	8
428	M	Veal-other organ meats	1.000000	1.000	1.000	8
429	M	Veal-dried	0.000250	1.920	1.000	3
430	M	Veal-meat byproducts	0.000400	1.000	1.000	5
437	15	Wheat-germ oil	0.000310	1.000	1.000	

Attachment 5. RDF Files used in DEEM for the Acute Assessment. The name of the commodity for each RDF is listed and is followed by the actual RDF file.

RDF #1 for Guava

Guava
TOTALZ=9

.05

RDF #2 for Macadamia Nuts

Macadamia
TOTALZ=43
TOTALFREQ=1

57,.10

RDF #3 for Beef Muscle

BEEF MUSCLE
TOTALZ=16
TOTALFREQ=1

84, .0049

RDF #4 for Milk

MILK
TOTALZ=16
TOTALFREQ=1

84, .0006

RDF #5 for Beef Kidney

beefkidney
TOTALZ=16
TOTALFREQ=1

84, .0053

RDF #6 for Fresh Sweet Corn

ATRAZINE-FRESH
SWEETCORN
TOTALZ=40
TOTALFREQ=2

42, .000185
18, .0005

RDF #7 for Processed Sweet Corn

ATRAZINE-PROCS
WEETCORN
TOTALZ=35
TOTALFREQ=2

45, .000185
20, .0005

RDF #8 for Beef Fat and Liver

ATRAZINE-BEEF-F
AT&LIVER
TOTALZ=16
TOTALFREQ=1

84, .003

RDF #9 for Wheat Grain

atrazine-wheat
TOTALLOD=1536
LODRES=.000352

0.10912
0.0352
0.02816
0.02816
0.02464
0.02464
0.01408
0.01408
0.01408
0.01408
0.01056
0.01056
0.01056
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0.01056
0.01056
0.01056
0.01056
0.01056

Attachment 5. RDF Files used in DEEM for the Acute Assessment. The name of the commodity for each RDF is listed and is followed by the actual RDF file.

Attachment 6 (A) Sensitivity Analysis Results for the Chronic Assessment for Chloro-metabolites

```
U.S. Environmental Protection Agency                              Ver. 7.075
DEEM Chronic analysis for ATRAZINE                              (1989-92 data)
Residue file name: D:\atzchronicsens2.RS7        Adjustment factor #2 NOT used.
Analysis Date 01-04-2001/15:27:00     Residue file dated: 01-03-2001/16:09:37/8
Reference dose (RfD, Chronic) = .0018 mg/kg bw/day
COMMENT 1: sensitivity analysis - chronic assessment for atrazine and chloro-metabolites
===============================================================================
                    Total exposure by population subgroup
-------------------------------------------------------------------------------
```

Population Subgroup	Total Exposure mg/kg body wt/day	Percent of Rfd
U.S. Population (total)	0.000004	0.2%
U.S. Population (spring season)	0.000004	0.2%
U.S. Population (summer season)	0.000004	0.2%
U.S. Population (autumn season)	0.000005	0.3%
U.S. Population (winter season)	0.000004	0.2%
Northeast region	0.000004	0.2%
Midwest region	0.000005	0.3%
Southern region	0.000004	0.2%
Western region	0.000004	0.2%
Hispanics	0.000005	0.3%
Non-hispanic whites	0.000004	0.2%
Non-hispanic blacks	0.000004	0.2%
Non-hisp/non-white/non-black	0.000005	0.3%
All infants (< 1 year)	0.000006	0.3%
Nursing infants	0.000001	0.1%
Non-nursing infants	0.000008	0.5%
Children 1-6 yrs	0.000015	0.8%
Children 7-12 yrs	0.000008	0.4%
Females 13-19 (not preg or nursing)	0.000004	0.2%
Females 20+ (not preg or nursing)	0.000002	0.1%
Females 13-50 yrs	0.000003	0.1%
Females 13+ (preg/not nursing)	0.000004	0.2%
Females 13+ (nursing)	0.000004	0.2%
Males 13-19 yrs	0.000005	0.3%
Males 20+ yrs	0.000002	0.1%
Seniors 55+	0.000002	0.1%
Pacific Region	0.000004	0.2%

```
U.S. Environmental Protection Agency                              Ver. 7.075
DEEM Chronic analysis for ATRAZINE                               (1989-92 data)
Residue file name: D:\atzOHsens2b.RS7           Adjustment factor #2 NOT used.
Analysis Date 01-05-2001/13:15:48     Residue file dated: 01-05-2001/13:12:27/8
Reference dose (RfD, Chronic) = .01 mg/kg bw/day
COMMENT 1: sensitivity analysis for the hydroxy-metabolites of atrazine
===============================================================================
                    Total exposure by population subgroup
-------------------------------------------------------------------------------
```

Population Subgroup	Total Exposure mg/kg body wt/day	Percent of Rfd
U.S. Population (total)	0.000003	0.0%
U.S. Population (spring season)	0.000003	0.0%
U.S. Population (summer season)	0.000003	0.0%
U.S. Population (autumn season)	0.000003	0.0%
U.S. Population (winter season)	0.000003	0.0%
Northeast region	0.000003	0.0%
Midwest region	0.000003	0.0%
Southern region	0.000003	0.0%
Western region	0.000003	0.0%
Hispanics	0.000003	0.0%
Non-hispanic whites	0.000003	0.0%
Non-hispanic blacks	0.000004	0.0%
Non-hisp/non-white/non-black	0.000003	0.0%
All infants (< 1 year)	0.000007	0.1%
Nursing infants	0.000002	0.0%
Non-nursing infants	0.000009	0.1%
Children 1-6 yrs	0.000008	0.1%
Children 7-12 yrs	0.000006	0.1%
Females 13-19 (not preg or nursing)	0.000003	0.0%
Females 20+ (not preg or nursing)	0.000002	0.0%
Females 13-50 yrs	0.000002	0.0%
Females 13+ (preg/not nursing)	0.000002	0.0%
Females 13+ (nursing)	0.000003	0.0%
Males 13-19 yrs	0.000004	0.0%
Males 20+ yrs	0.000002	0.0%
Seniors 55+	0.000002	0.0%
Pacific Region	0.000003	0.0%

Attachment 6 (C) Sensitivity Analysis Results for the Acute Dietary Exposure Assessment for Chloro-metabolites

U.S. Environmental Protection Agency Ver. 7.075
DEEM ACUTE analysis for ATRAZINE (1989-92 data)
Residue file: atzacutesens2.RS7 Adjustment factor #2 NOT used.
Analysis Date: 01-11-2001/17:23:52 Residue file dated: 01-11-2001/17:02:06/8
NOEL (Acute) = 10.000000 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
MC iterations = 1000 MC list in residue file MC seed = 10
Run Comment: "1000X on chronic RfD: 1000X on acute RfD"
===

Summary calculations (per capita):

95th Percentile			99th Percentile			99.9th Percentile		
Exposure	% aRfD	MOE	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE
U.S. Population:								
0.000026	0.26	391178	0.000046	0.46	218162	0.000073	0.73	136597
Females 13-50 yrs:								
0.000016	0.16	632944	0.000024	0.24	414302	0.000041	0.41	246810

Attachment 7. Quantitative Usage Analysis from BEAD

Chemical	Case	PC Code	Date	Analyst
Atrazine	0062	80803	January 10, 2001	David Widawsky

Quantitative Usage Analysis

Atrazine is an herbicide registered mainly to broadleaf weeds in a number of sites. The most use occurs in corn, although substantial use also occurs in sorghum and sugarcane. Agricultural crops that receive smaller total use include sweet corn and winter wheat that is going into a fallow period. Atrazine is also used on macadamian nuts, and guava but EPA has limited use data for these crops. Atrazine is also used on several non-agricultural sites, primarily on turf sites in Southern states by lawn care operators as well as golf courses and sod production.

Attachment 7. Quantitative Usage Analysis from BEAD

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Food Crops											
Sweet Corn, Fresh	222	110	133	50%	60%	160	180	1.5	1.0	1.5	FL NY GA MI NJ 84%
Sweet Corn, Proc.	464	270	300	58%	65%	250	350	0.9	1.0	0.9	WI MN OR NY IL 85%
Sorghum	11,140	6,520	8,213	59%	74%	7,790	12,575	1.2	1.1	1.1	KS TX NE MO 82%
Corn	72,425	59,500	69,900	75%	84%	63,800	74,495	1.1	1.1	1.0	IL IA NE IN OH MO 63%
Barley[1]	7,326	0	0	--	--	0	0	--	--	--	ND ID MN SD 81%
Oats/Rye[1]	6,184	0	0	--	--	0	0	--	--	--	OH AL SD OK VA NM 77%
Rice[1]	2,989	0	0	--	--	0	0	--	--	--	LA AR 82%
Wheat, Winter[2]	44,491	280	480	0.6%	1.1%	300	583	1.1	1.0	1.1	KS NE OK AL CO MS 76%
Sugarcane	855	650	810	76%	95%	2,550	4,900	3.9	1.5	2.6	FL LA 97%
Macadamian Nuts	20	11	missing	57%	missing	2	missing	missing	missing	0.2	
Guava		missing	missing	missing	missing	missing	missing	missing	missing	missing	
Non-food Agriculture											
Other Pasture, Rangeland	75,719	125	200	0.2%	0.3%	138	221	1.1	1.0	1.1	LA 82%
Summer Fallow	28,567	175	250	0.6%	0.9%	224	320	1.3	1.1	1.2	KS NE SD CO MO 82%

Attachment 7. Quantitative Usage Analysis from BEAD

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Silviculture											
Ornamentals, Woody	--	--	--	--		140	--	--	--		
Forestry		--	--	--	--	48	--	--	--	--	
Woodland	62,089	10	20	0%	0%	21	46	2.1	1.1	1.9	OR WI NY AR LA 80%
Christmas Trees	--	--	--	--	missing	missing	--	--	--		CA .%
Turf (in Southern States)											
Lawn Care Operators	31,048	--	--	--		600	--	--	--		
Sod	152	70	--	--	--	160	--	2.3	1.0	2.3	FL TX 91%
Golf Courses	1,440	--	--	--	--	78	--	--	--	--	

Attachment 7. Quantitative Usage Analysis from BEAD

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Professional, Commercial Applicators											
Roadways		--	--	--	--	100	--	--	--	--	
Outdoors (for hire)	--	--	--	--		7	--	--	--		
Outdoors Govt (not for-hire)	--	--	--	--	--	1	--	--	--		
Recreational Outdoors (for hire)	--	--	--	--		73	--	--	--		
Recreational Outdoors (not for-hire)	--	--	--	--		4	--	--	--		
Residential Outdoors (for hire)	--	--	--	--		41	--	--	--		
Industrial Facilities	--	--	--	--		93	--	--	--		
Office Govt Outdoors (not for-hire)	--	--	--	--		2	--	--	--		

Attachment 7. Quantitative Usage Analysis from BEAD

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Office/Retail Outdoors (for hire)	--	--	--	--		12	--	--	--		
Landscape Maintenance	--	--	--	--		2	--	--	--		
Rights of way	--	--	--	--		5	--	--	--		
Total		67,602	67,604			76,480	84,924				

[1] EPA records indicate that these crops were not treated with atrazine after 1996.
[2] EPA records indicate that atrazine use on wheat fields represents primarily post-harvest applications prior to entering a fallow period.
Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA

Usage data primarily covers 1990 - 1996.
Calculations of the above numbers may not appear to agree because they are displayed as rounded:
to the nearest 1000 for acres treated or lb. a.i. (Therefore 0 = < 500)
to the nearest 1/10 percentage point for % of crop treated.
0* = Available EPA sources indicate that no usage is observed in the reported data for this site, which implies that there is little or no usage.

Attachment 7. Quantitative Usage Analysis from BEAD

A dash (-) indicates that information on this site is NOT available in EPA sources or is insufficient.
SOURCES: EPA data (1990-1999), USDA - NASS (1990-1999)